

Lewis Baker

A MANUAL
OF COST CUTS
FOR STRONG
ACCEPTABLE
HOUSING

COSTFORD

THE AUTHOR

Baker's life is a legend. He belongs to a rare species of scholars who found the roots of wisdom in common man. Laurance Wilfred Baker was born in England in 1917. He had his education from King Edwards Grammar School, Aston. After studying at the Birmingham School of architecture, he became an Associate of the Royal Institute of British Architects. He started his career as an anaesthetist to Friends Ambulance Unit, S. England during the world war and worked in China and Burma.

As an architect to a leprosy mission, he came to India in 1945 where he was exposed to an entirely new environment. He was fascinated to see the skills of ordinary, poor village people working with the most unpromising and crude materials with almost no recognizable tools to make useful everyday buildings and articles.

In 1948 Baker married Elizabeth Jacob, a like minded doctor from Kerala and settled down in remote area of the Himalayas to run their own schools and hospitals - mixture of medical and architectural work there for more than one and a half decades.

The land and its people enlightened his ideas and the compendium of information from ordinary people enriched his vision. He discovered a hidden heritage in the local indigenous style of architecture, the result of thousands and thousands of years of research and collective experience of many generations on how to use only immediately available, local materials to make structurally stable buildings that could cope with the local climatic conditions, with the local geography and topography, with all the hazards of nature, with possible hostile neighbours, houses that could accommodate all the requirements of local religious, social and cultural patterns of living. He learnt about more and more local materials and devised new patterns using burnt bricks, stone, mud, tiles, and timber and applied new kinds of mortar and plaster in his works.

Baker abhorred all forms of extravagance and waste. Two important characteristics evolved in Baker's architecture-the small is not only beautiful but is often essential and even more important than large; and if architects are even to start interacting effectively with the real building problems and the housing needs of the world, they must learn how to build as inexpensive as possible. The ideal is that there is a form of direct unity with the creator, that man experiences this at any time, in any place and under any circumstances.

For a number of reasons, the Bakers pulled up their roots from the Himalayas and moved to Kerala and settled in a remote mountain area among the neglected tribals and settlers. Baker's interest and work spread and he concentrated more on housing and rural development work. Some industrial buildings in North and Mid-India, a lot of Churches and a Cathedral were his important contribution during this period.

By this time the Government moved in to examine what is going on. The then Chief Minister C. Achutha Menon became a convert to his architectural style and Baker built the State Institute of Languages for a small sum of money which the works and housing department had declared was impossible. Following this a fairly large and prestigious complex known as Centre for Development Studies and some other Government Institutions were constructed by him.

The people were quick to understand the principles involved in cost reduction and real priorities of building a house. The upper strata came forward with interest when quite a lot of them built their houses using these simple cost reducing techniques. For the lower middle class this style was rewarding as they can construct a house within their reach.

As a popular specialist in cost-effective building and conservation of energy by avoiding energy intensive materials - with a stress on updating the wonderful Indian vernacular ways and styles of building Baker brought people close to their culture. Throughout his working life, the whole business of planning and designing has been intensely absorbing and fun for him. Always living close to nature he learned many lessons from the design of God's creations. He has produced innumerable designs each has a unique identity whether big or small. He breaks all conventions of shape. The free flowing lines and graceful curves in his design create a harmonious atmosphere for living. His buildings invite the dweller to be part of it. Planning of space in design is an important factor in cost reducing construction. In a country with 40 million homeless it is improper to use money, natural resources or energy lavishly or unnecessarily.

As an architect of vision and vast experience Baker is an active participant of various Government schemes. He is and has been advisor to planning and Governing bodies of institutions such as HUDCO, NID, CBRI, FRI, UPDESCO etc. and have been active with and designed for Milk Marketing Board, Livestock Development Board. He is a honorary fellow of the Centre for Development Studies.

Baker defend critics with good humour and his sketches are excellent. He has produced do-it-yourself books, illustrated by him titled How to Reduce building costs, Brick work, Mud, Community buildings, Schools, Rural hospitals etc. His writings brims with information. In all he stresses cost control and avoiding energy waste and intensive materials. He has given two reports to Government on Earthquake.



A MANUAL OF COST CUTS FOR STRONG ACCEPTABLE HOUSING

by Lewis Baker

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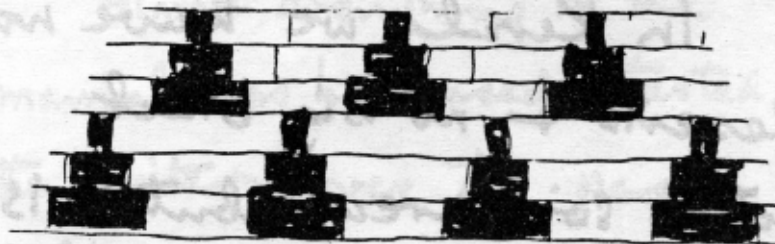
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MANUAL
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COSTFORD

This manual is mainly put together to help deal with working out inexpensive, effective & acceptable housing schemes for the homeless families in Kerala.

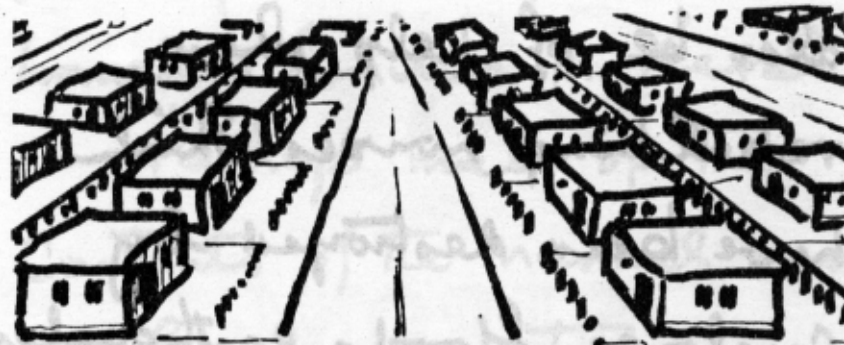
Perhaps much of the contents of the manual may be of relevance to many other parts of India.

In Kerala we have no deserts & no big black cotton soil areas, but it is hoped that some sections

of the manual will be of help to anyone planning to build small houses on small plots for homeless families.

Some of the material may also be of help when rebuilding houses which have been destroyed by cyclones, floods, earthquakes, landslides & so on.

Almost everything in the manual has been used & tested by the writer over the past half a century in India.



This is the usual unplanned colony, made by the occupants, with mainly waste materials & with no thought of "planning".

This is the currently fashionable 'modern' new colony - long straight roads with identical cement block & roof 'boxes' in straight rows.

The third sketch is what a colony could look like - for much less cost - with houses of equal area, but different plans & designs chosen by the occupant. The houses are in clusters round a common area to be used for community work, play & recreation. Each 'cluster' adjoins a road.

TRADITION v MODERN

This is not meant to be a battle between traditional & modern forms of architecture.

Especially in India there is no such thing as ONE Traditional INDIAN Architecture.

Every district has its own traditions &, by trial & error, over thousands of years, people have learned how to use, and to cope with, all the many factors which are involved in Architecture.

-The Site, the Topography & Geology, the climate & vegetation, the available local materials - the religious & cultural patterns of living, & the main local occupations.

Unsatisfactory items have long since been discarded & alternatives have been tried until a Satisfactory Solution has been found.

It seems foolish, therefore, to abandon the tested findings of centuries of "Science & Technology".



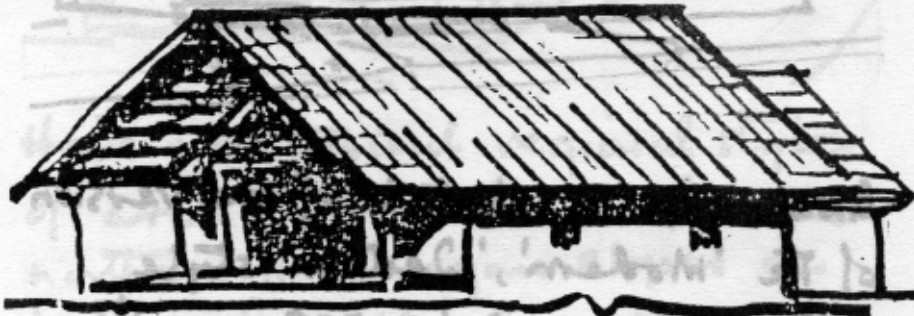
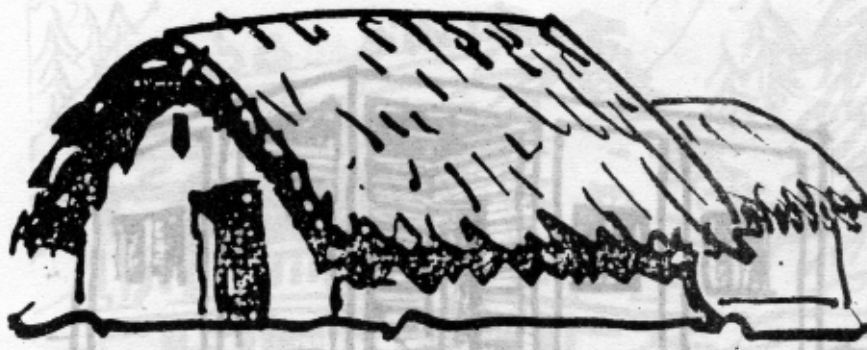
Here are typical regional styles of architecture - above from the northern Himalayan slopes & below from Kerala in the South.





Above is a sketch of one version of the 'Modern', 'Western' style which can now be seen in the North, South, East, West & Middle of India.

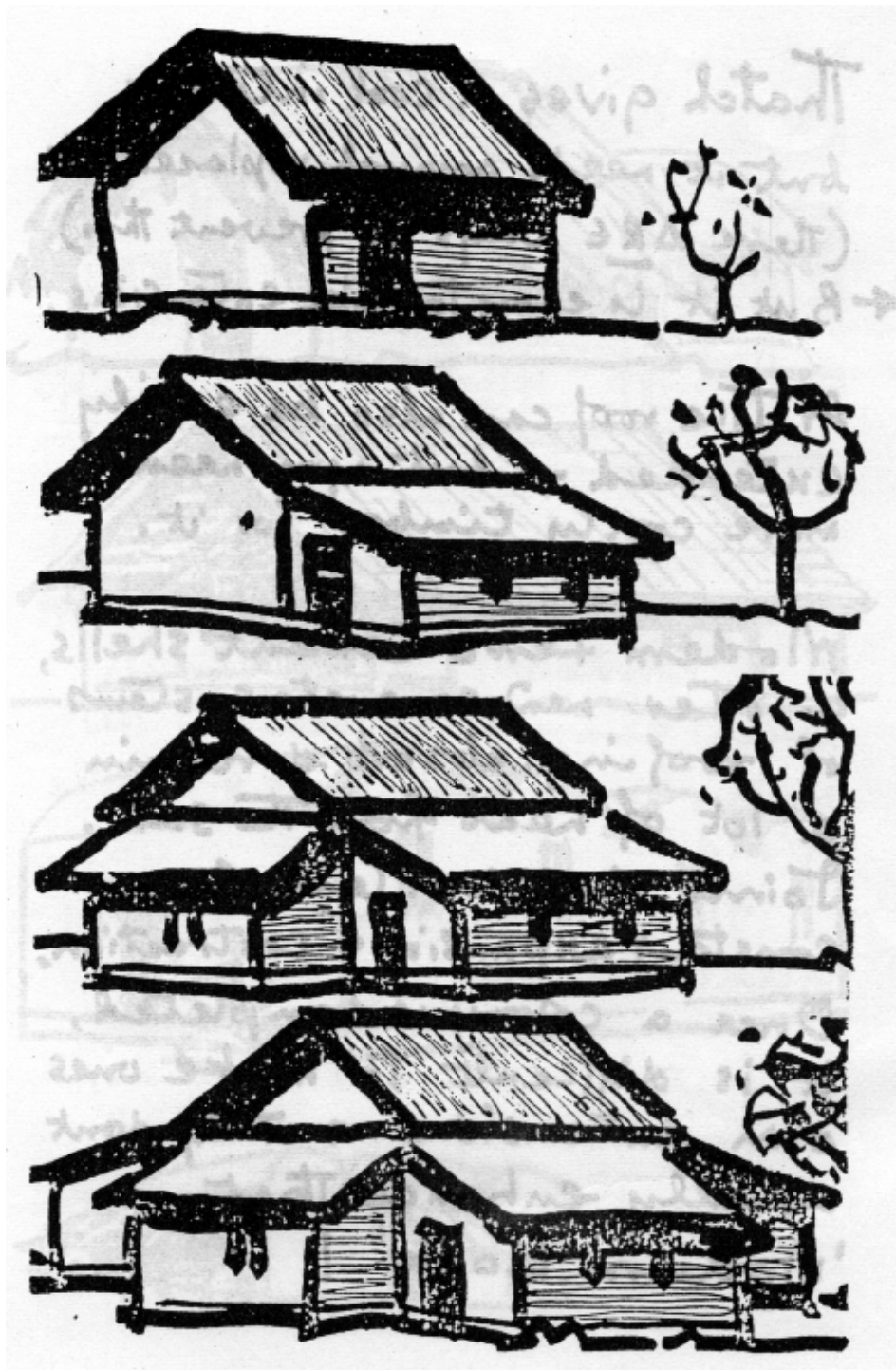
It is built of costly energy intensive materials & has no regard for site, topography, climate, culture or religion, occupations or way of local life of the occupants.



Thatch gives a cool interior
but it needs annual replacement
(There ARE ways to prevent this)
→ But it is easy to make extensions.

A Tile roof can also be easily
extended — but you need
more costly timber for it.

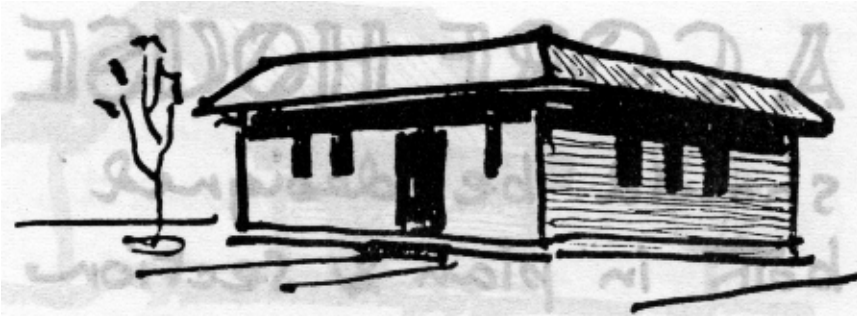
Modern Ferro-Cement shells,
& other new concrete systems
of roofing, absorb & retain
a lot of heat from the sun.
Joints also soon leak from
constant expansion & contraction.
Once a colony is completed,
it is difficult to make ones
own extensions & they don't
usually enhance that
'Modern Look' !



A CORE HOUSE

should be designed both in plan & section so that as & when extensions are to be added, roofs, doors, windows etc are in the right places.

The original unit must also be carefully placed on the plot so that there is space for extension on all sides & bye-laws re distance from boundaries are not broken.



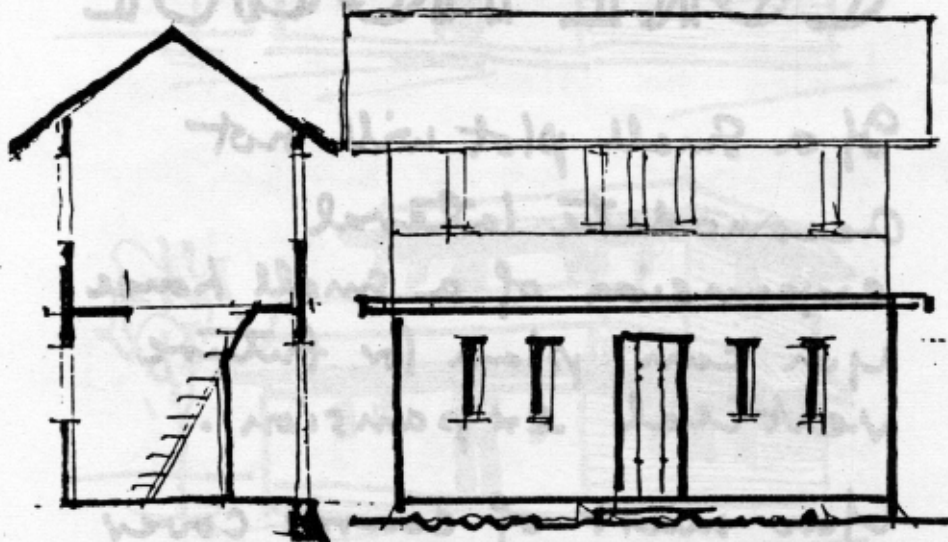
A VERTICAL CORE HOUSE

If a small plot will not accommodate lateral expansion of a small house you can plan for future vertical expansion.

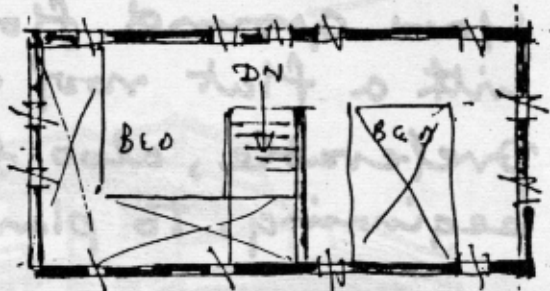
You must of course cover your ground floor rooms with a flat roof & it is preferable, also from the beginning, to plan for stairs.

These will make your flat roof usable, & of course will eventually connect the additional floors with the original ground floor.

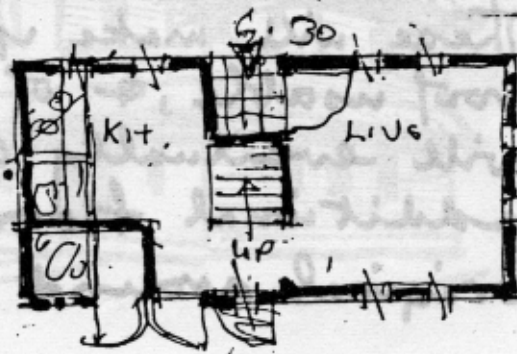
FUTURE VERTICAL EXPANSION



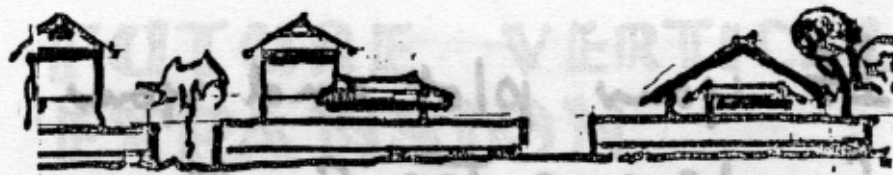
FUTURE
FIRST
FLOOR



GROUND
FLOOR.

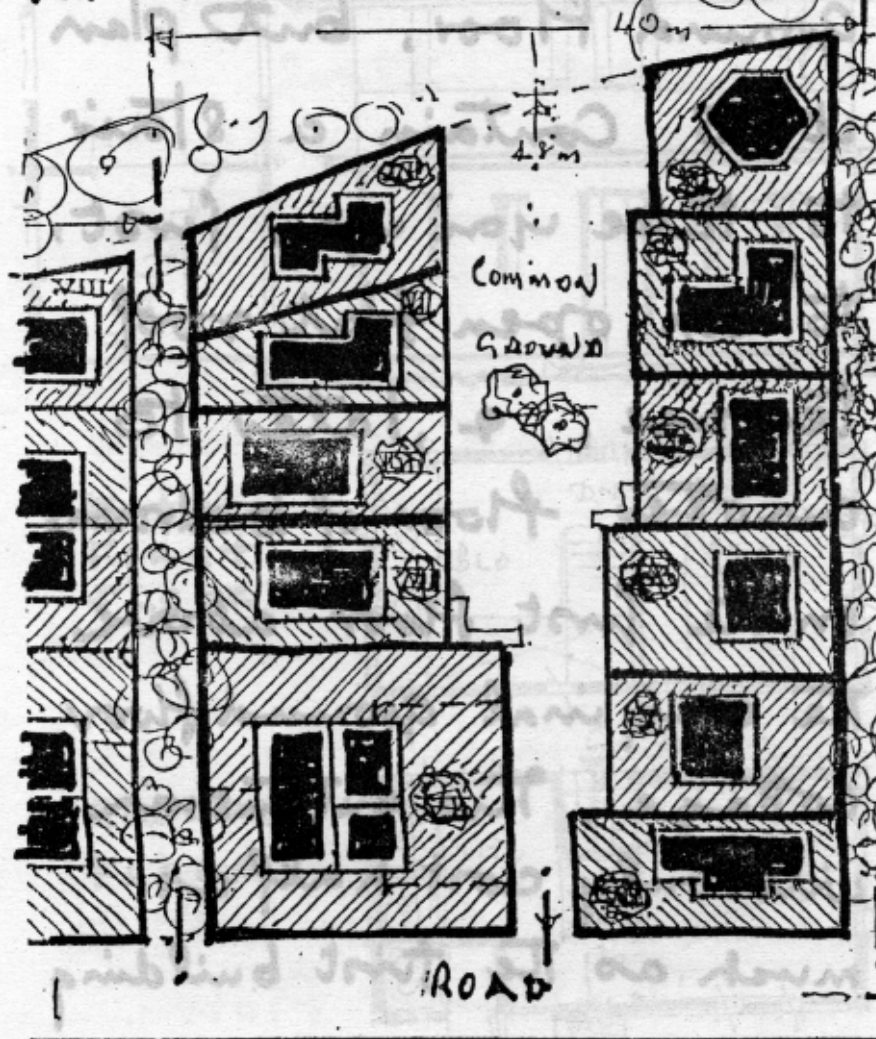


If your plot and your funds are too small, start off with the ground floor, but plan it to contain a stair to take you up, first, to an open flat roof terrace, & later to another floor of bedrooms on the first floor above the original ground floor cottage. This extension will only cost half as much as the first building



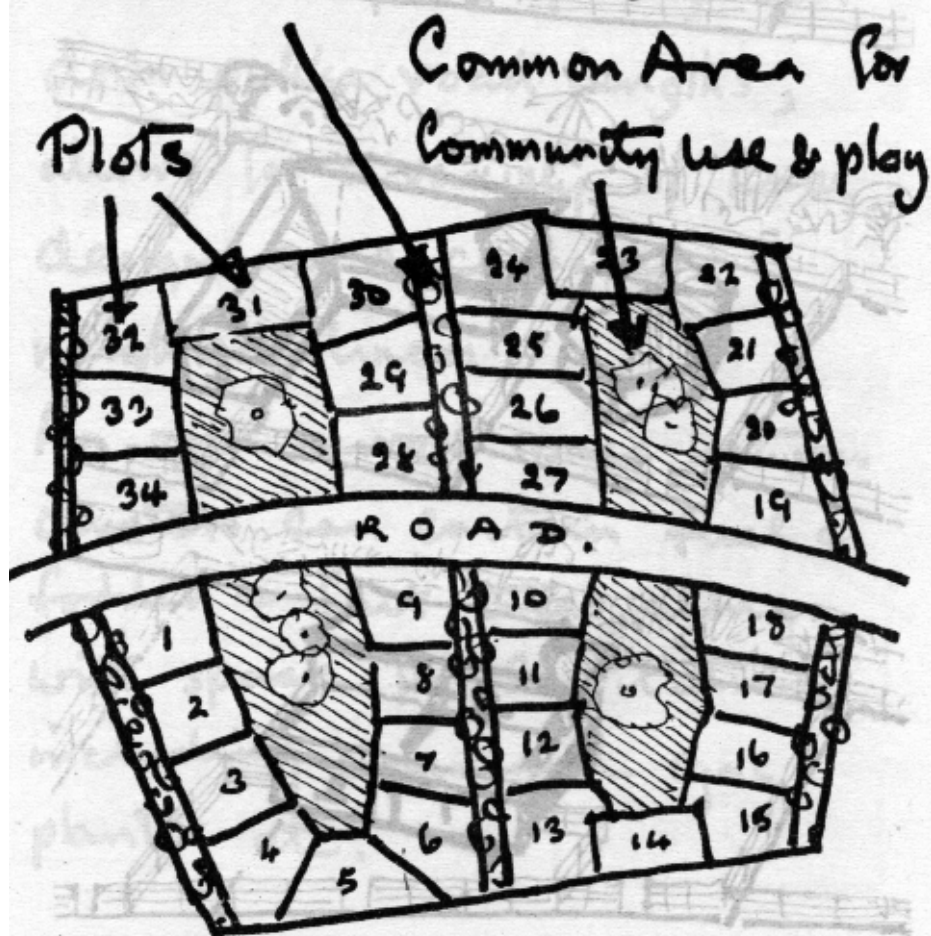
All plots the same area

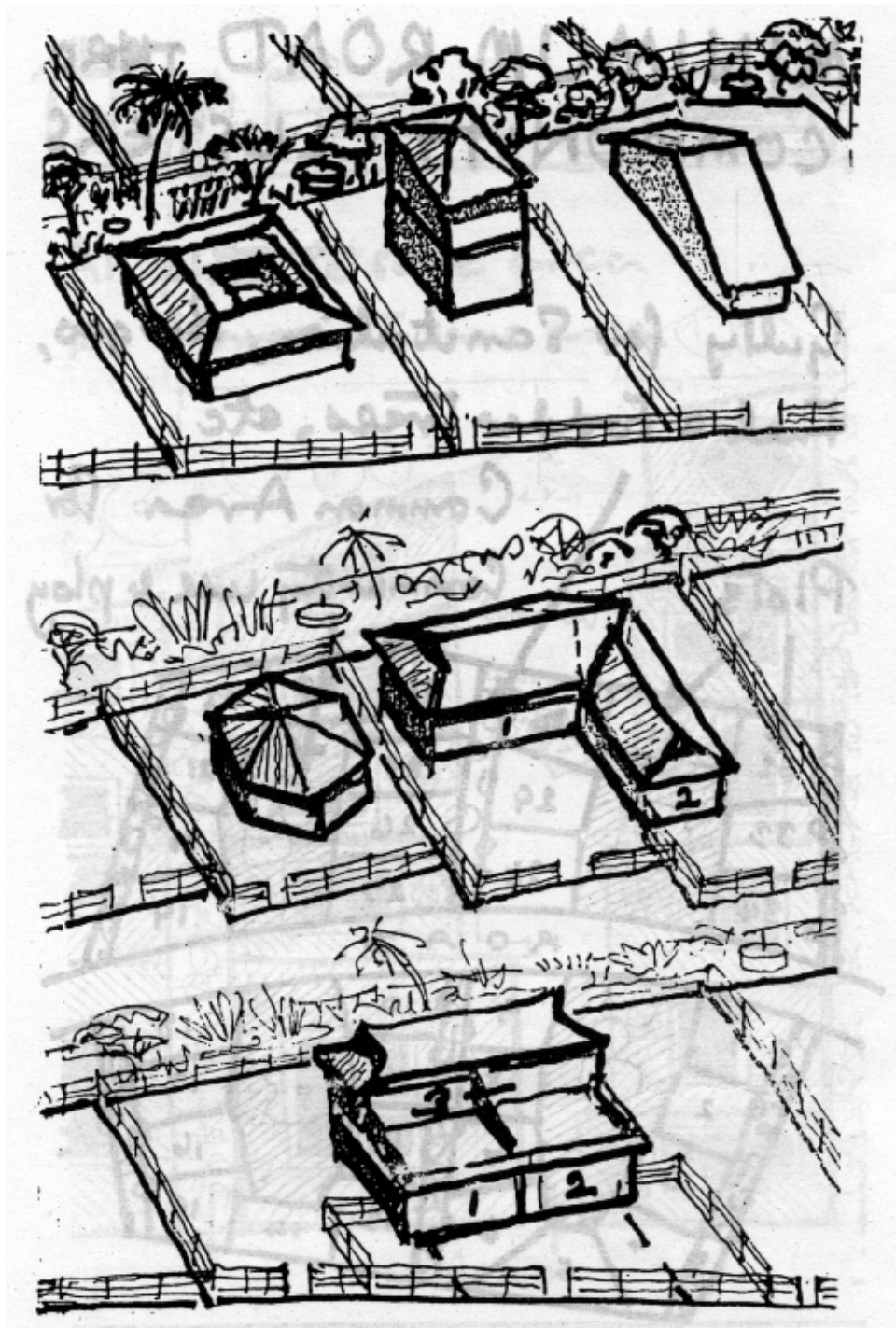
All houses the same area



MINIMUM ROAD THRO COMMUNITY CLUSTERS

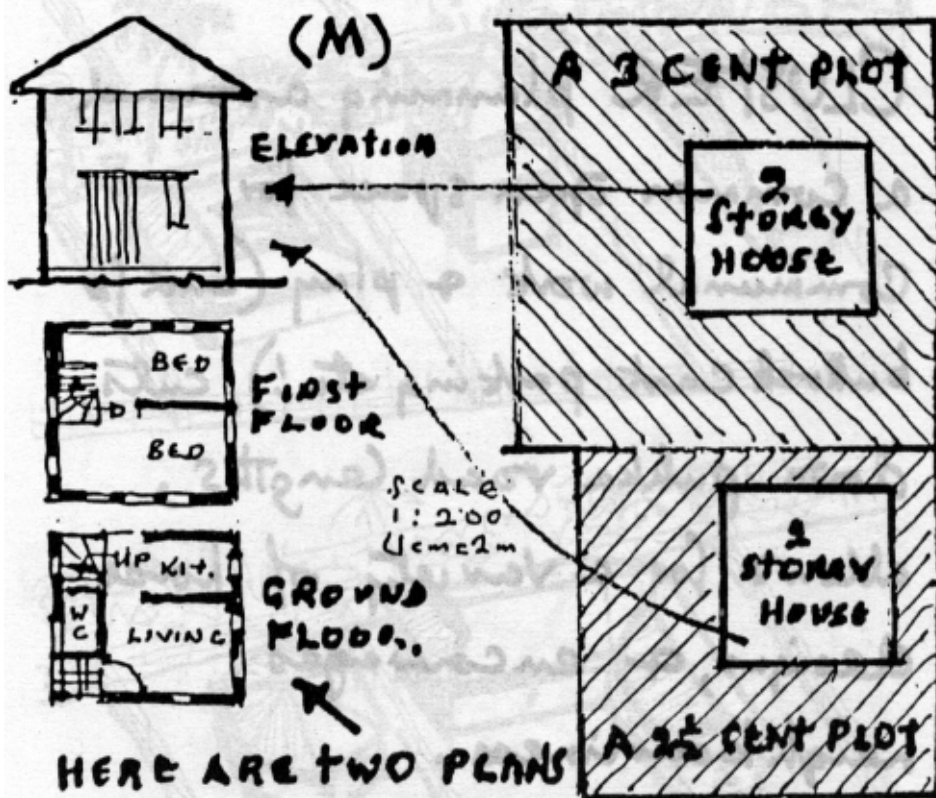
Gully for Sanitation, Biogas,
Fuel & Fodder trees, etc.



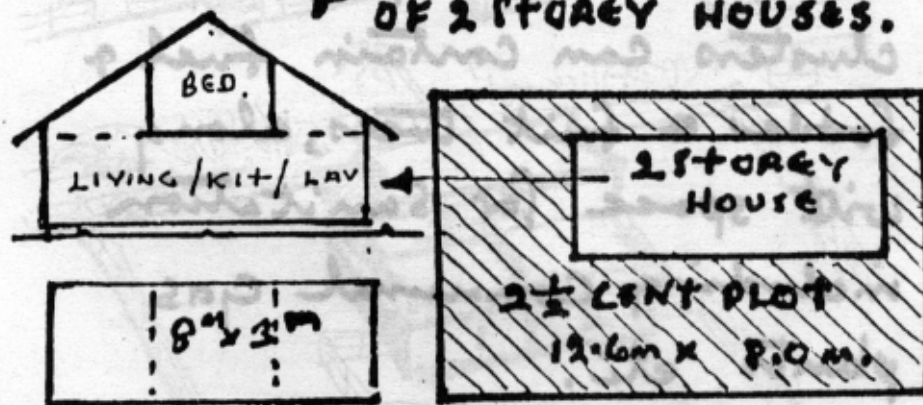


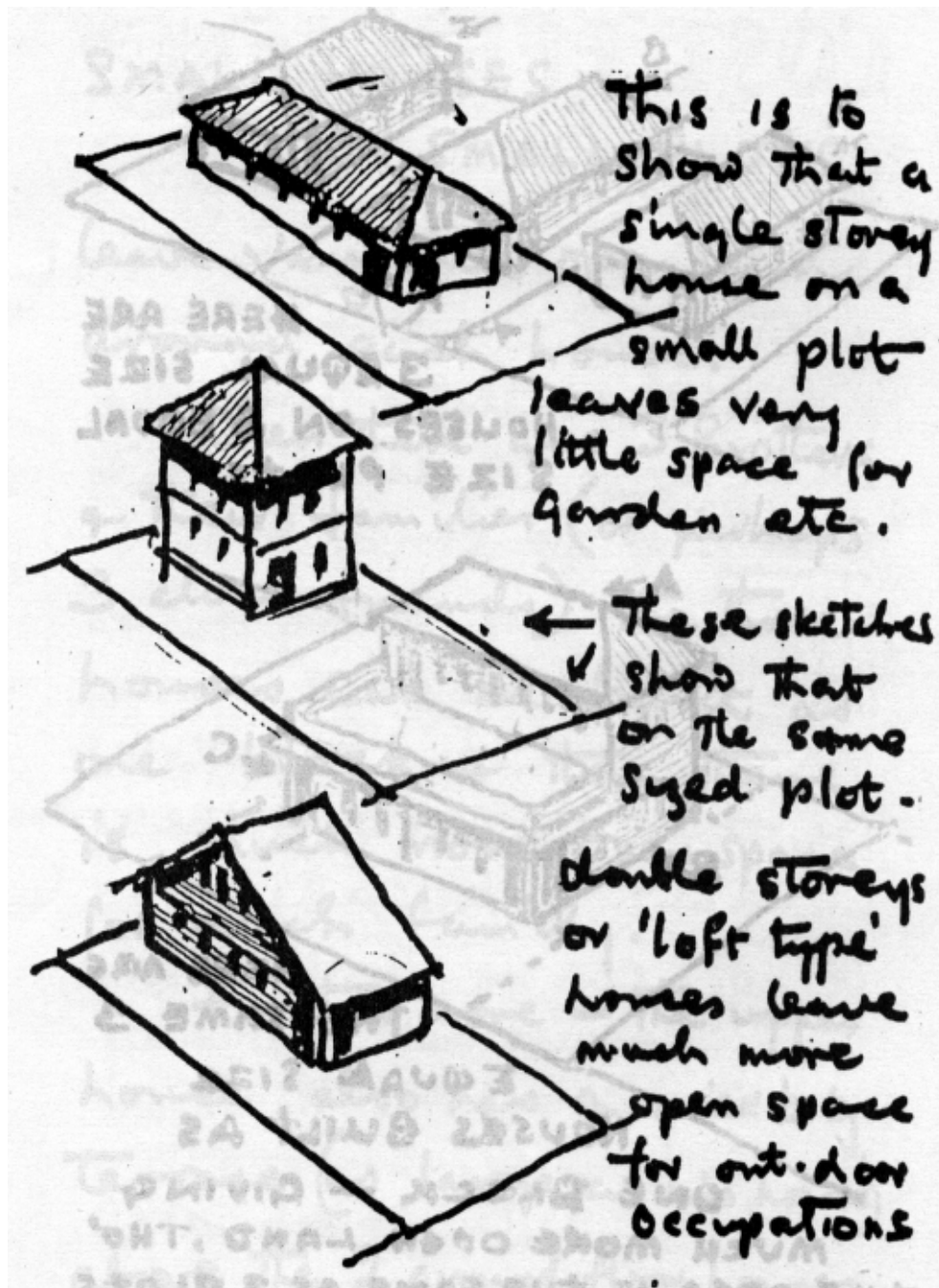
CLUSTER planning around a common open space for communal work & play (and for bullock cart parking etc!) cuts down pukka road lengths, allows for a variety of house designs, & encourages neighbourliness.

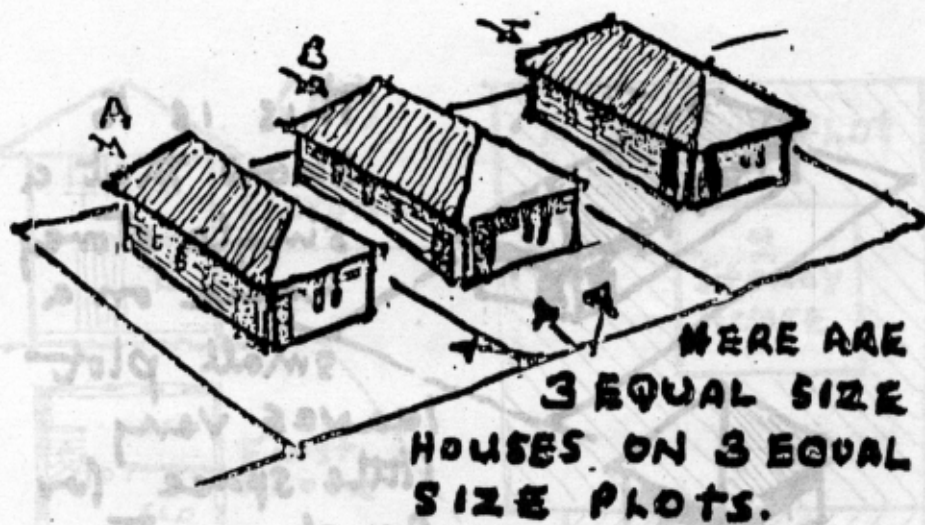
An open narrow space between clusters can contain fuel & fodder & fruit trees, along with space for sanitation including communal gas plants etc.



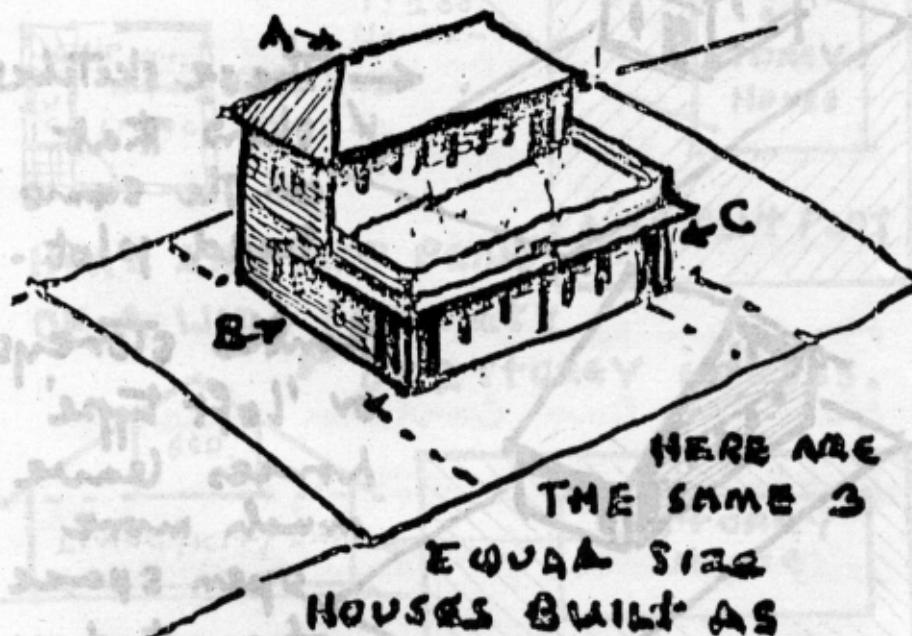
HERE ARE TWO PLANS
OF A WIDE VARIETY
OF 2 STOREY HOUSES.







HERE ARE
3 EQUAL SIZE
HOUSES ON 3 EQUAL
SIZE PLOTS.



HERE ARE
THE SAME 3
EQUAL SIZE
HOUSES BUILT AS
ONE BLOCK — GIVING
MUCH MORE OPEN LAND, THO'
THE AREA IS THE SAME AS 3 PLOTS

SMALL HOUSES ON SMALL PLOTS

leave very little open land
around each house.

When there are 3 Brothers
& their families (or perhaps
3 close friends) the three
houses can be built as
one block & then there
is much more open space
for each family.

Further more - The upper
house also has a nice big
terrace (as large as his house)
above the 2 ground floor houses.

COST EFFICIENCY

With The Country having millions of homeless families, it is imperative that what money is available must be used only for essentials, & none of it for fancy frills!

There are many factors that must be kept in mind. MATERIALS - Are the materials we want to use for building LOCALLY AVAILABLE?

If not - can we afford Transport costs? Can we not use only locally available items as far as possible?

Then we must ALWAYS keep the CLIENT in mind.

Remember that the CLIENT is the beneficiary—not a Government Department etc!

Will he be able to accommodate comfortably all his dependents?

Will he be able to extend the house when, later, his sons grow up & earn money?

Will the house be strong and Secure?

Can sheds or verandahs be added by him for home occupations, like carpentry or weaving, etc?

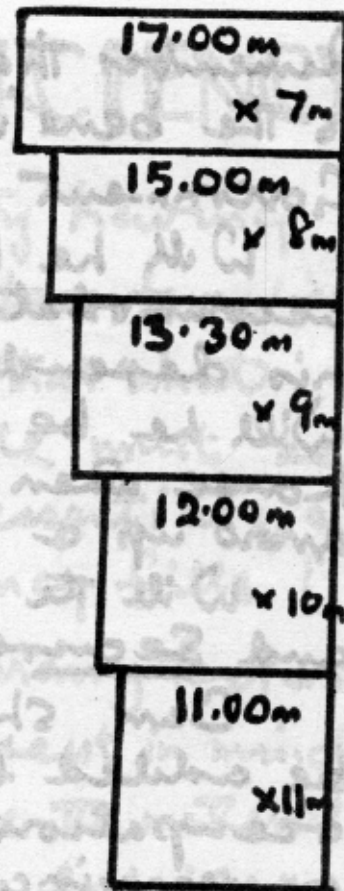
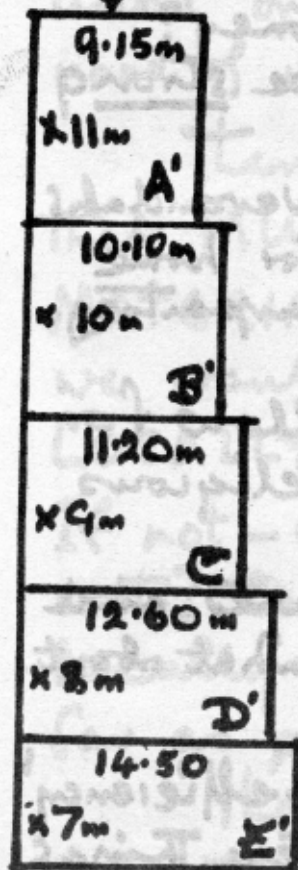
Does the plan allow for local cultural & religious ways of living?

What about water and Sanitation? And what about approachability.

Our aim of 'cost-efficiency' must include all these things.

PLOT SIZES

All these plots
are the same
area
2.5 cents



All these plots
are the same
area -
- 3 cents.

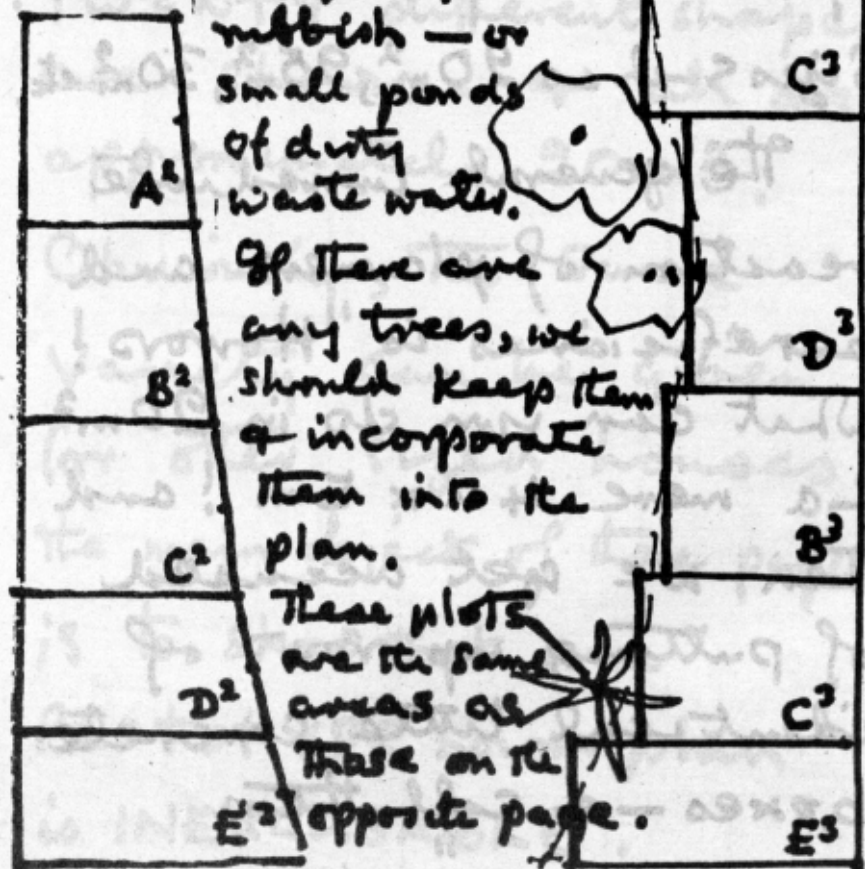
& of course there
will often be
irregular shapes.

Plot SHAPES need not always be square or rectangular.

Very often land available for community housing is irregular waste land — often with waste dumps of rubbish — or small ponds of dirty waste water.

If there are any trees, we should keep them & incorporate them into the plan.

These plots are the same areas as those on the opposite page.



HOUSE PLAN SIZES

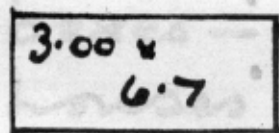
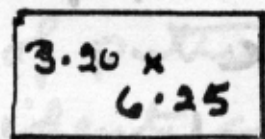
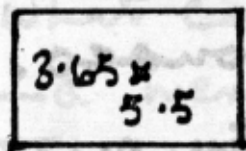
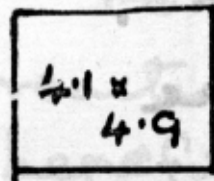
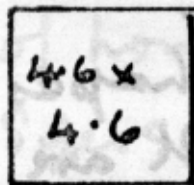
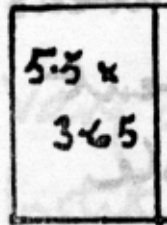
Very often, Authorities and Institutions limit the SIZES of houses they intend to build: Sizes such as 20m^2 , 25m^2 , 30m^2 etc.

The general immediate reaction of planners and beneficiaries is "Horror! What can you do in 20m^2 — a mere $4\text{m} \times 5\text{m}$! and Then we get accused of putting up rows of identical little concrete boxes — & call them houses....."

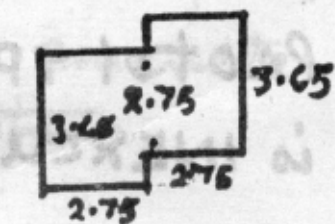
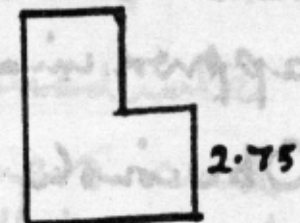
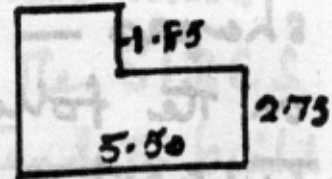
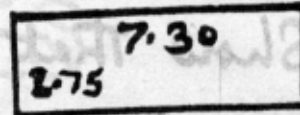
The following pages are to
Show That such small areas
can be in many different
shapes — for example
on the following page
Twenty different shapes
are shown — & all are
approximately 20 m^2 .

Obviously, the same
Variety can be given
for other sized houses.
The main object of these pages
is to show that one
PROTOTYPE house plan
is INEXCUSABLE.

20 m²



20 m²



20 m²

All these shapes

are about

20 m².

Further

pages

will

show

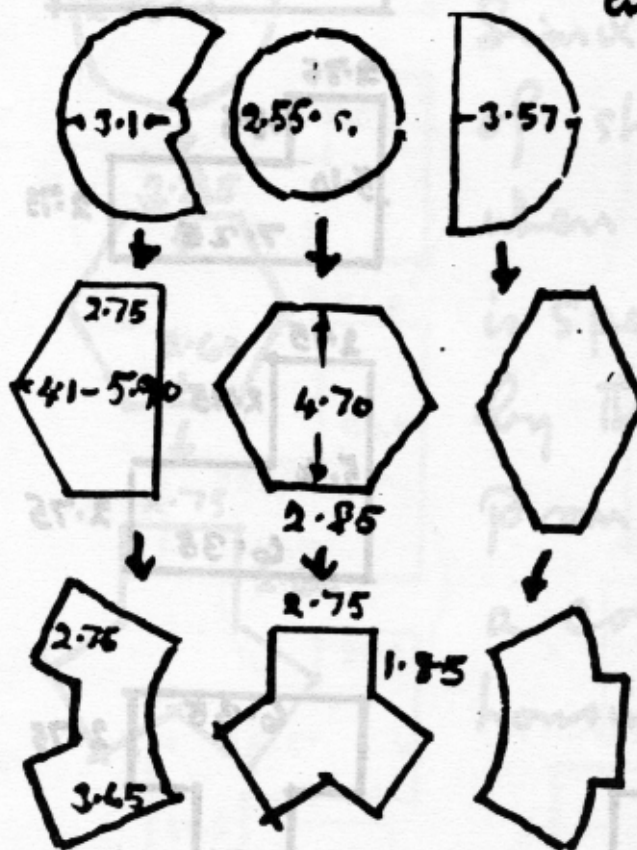
that

each

shape

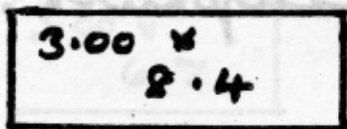
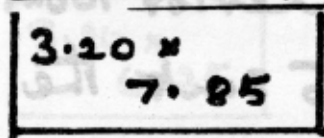
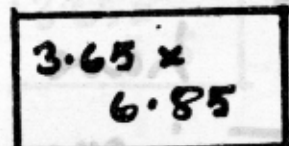
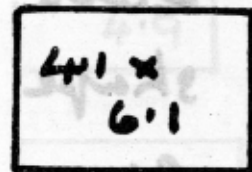
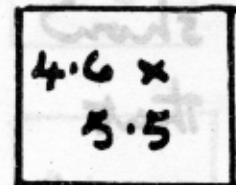
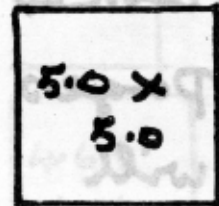
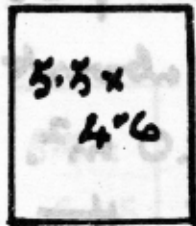
can

have

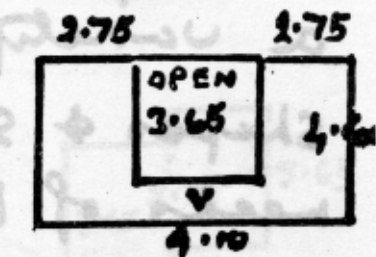
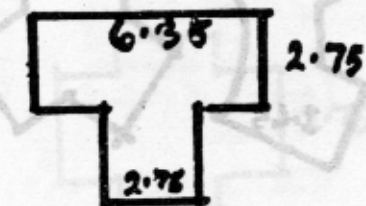
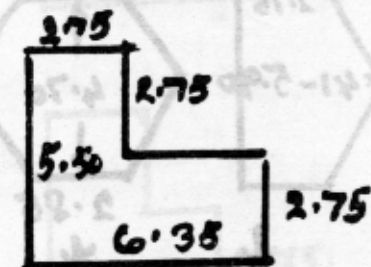
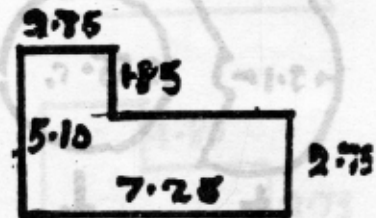
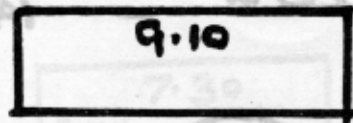


a variety of interior room
shapes & sizes to suit the
needs of the occupants.

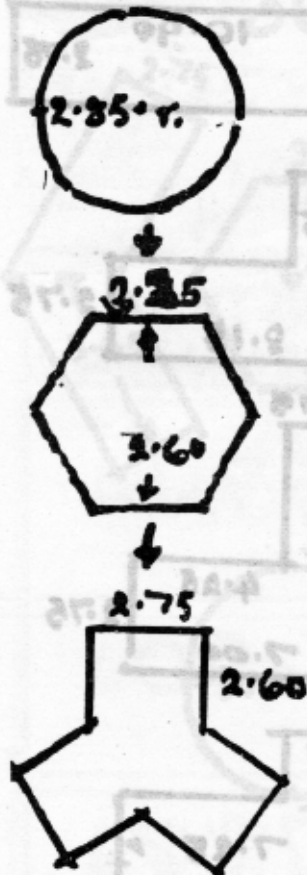
25 m²



25 m²



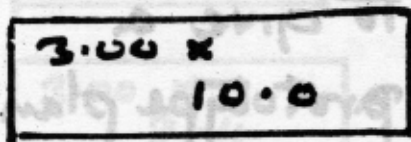
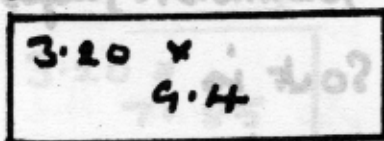
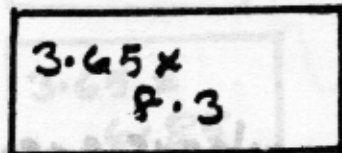
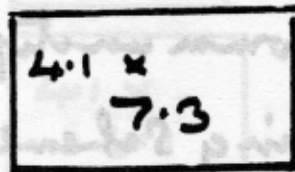
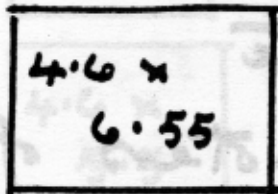
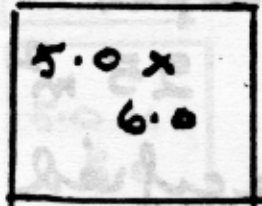
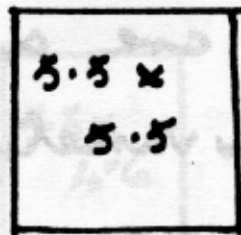
25 m²



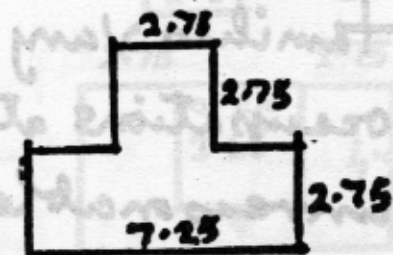
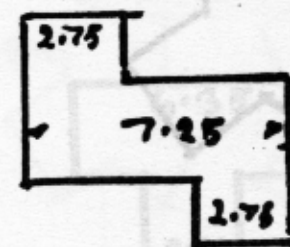
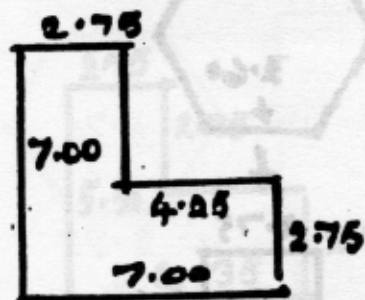
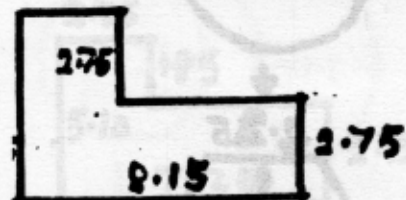
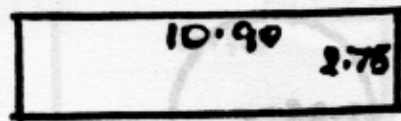
There are a
Similar variety
of shapes
when 25 m²
is specified
by the
promoters of
a community
housing scheme

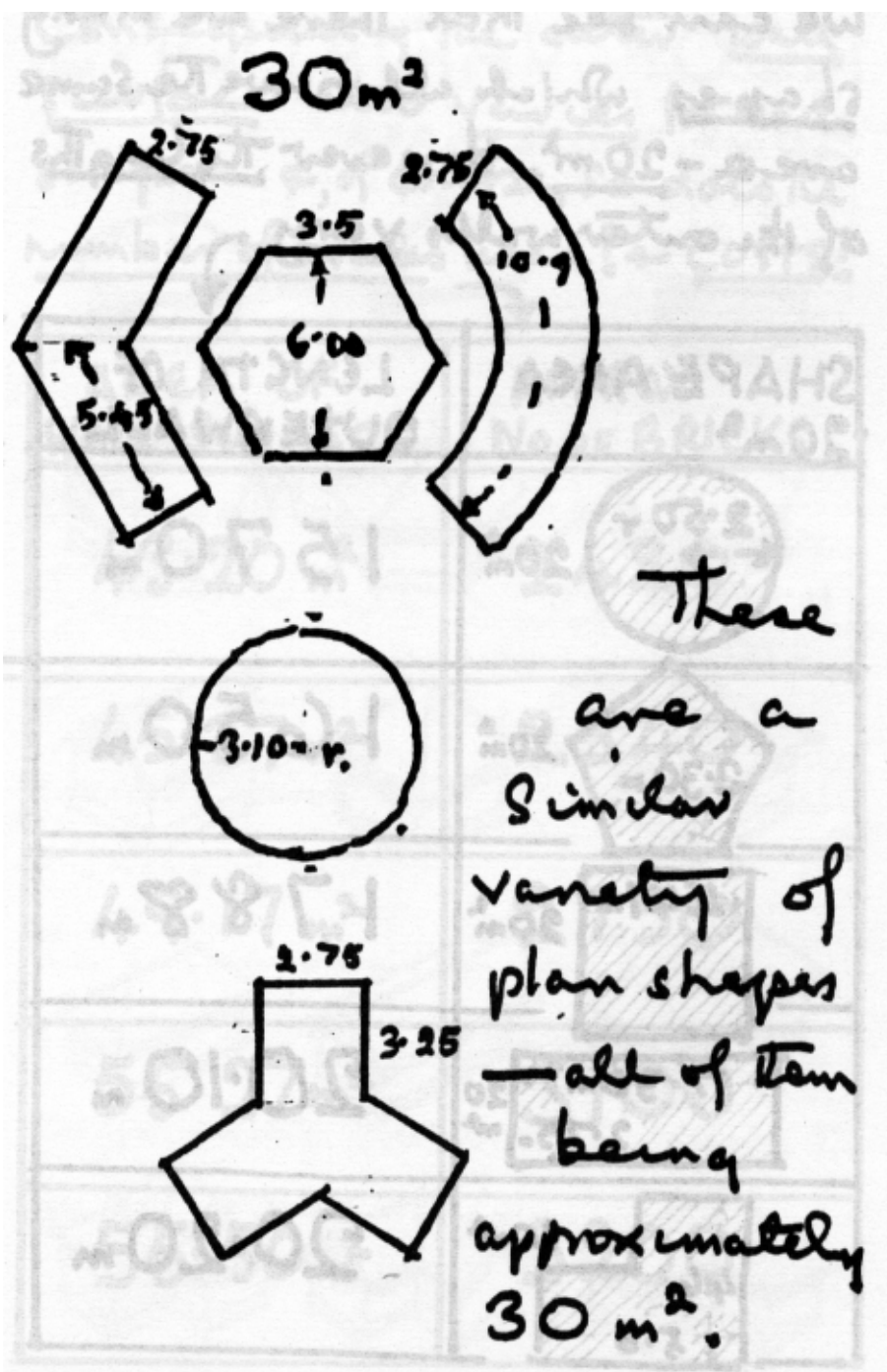
Families vary in numbers, ages,
occupations etc - So it is
unreasonable to give a
community ONE prototype plan.

30 m²




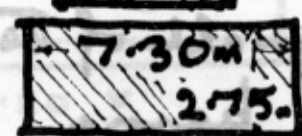



30 m²





We can see that there are many shapes which all have the same area - 20 m^2 . However the lengths of the outer walls vary \rightarrow

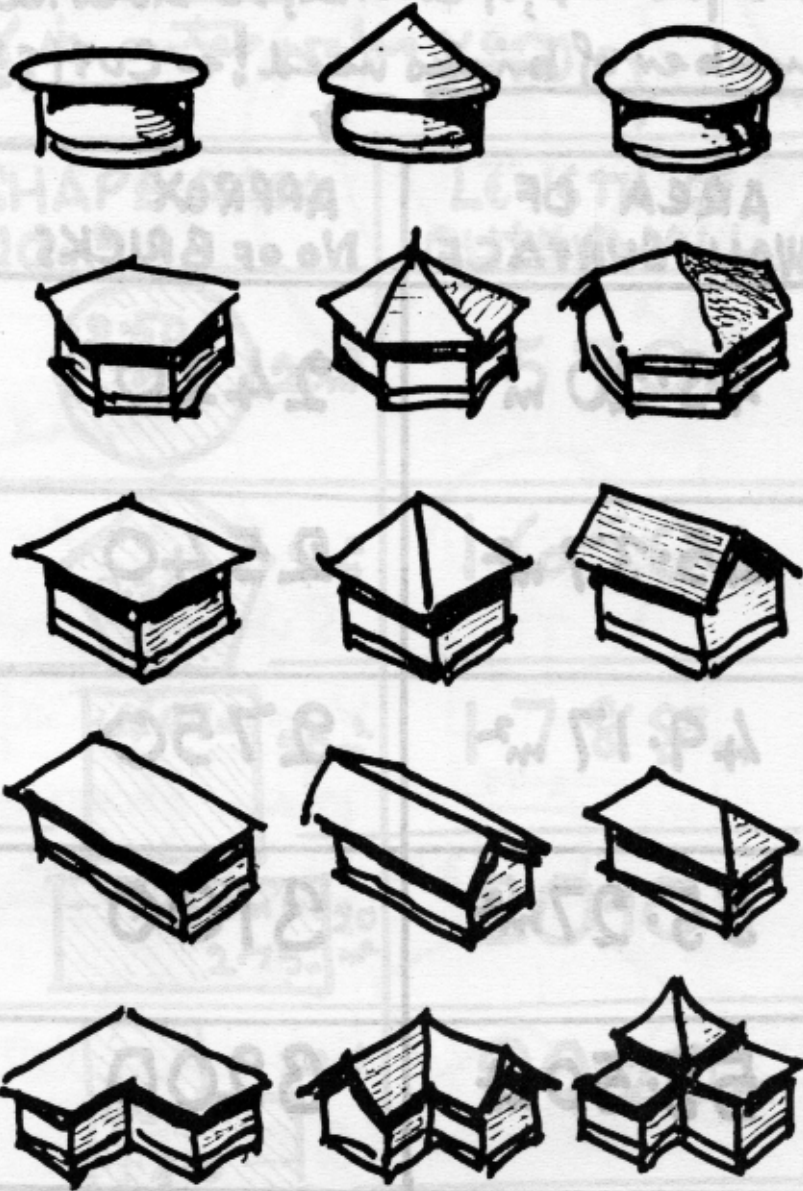
SHAPE AREA 20 m^2	LENGTH OF OUTER WALL
 20 m^2	1570 m
 20 m^2	1650 m
 20 m^2	1788 m
 20 m^2	20.10 m
 20 m^2	20.20 m

Consequently the outer wall surface also varies for each shape - & of course, so does the number of bricks used! + costs!

AREA OF WALL SURFACE	APPROX NO OF BRICKS
43.20 m ²	2420
45.37 m ²	2540
49.17 m ²	2750
55.27 m ²	3100
55.50 m ²	3200

ROOF VARIATIONS

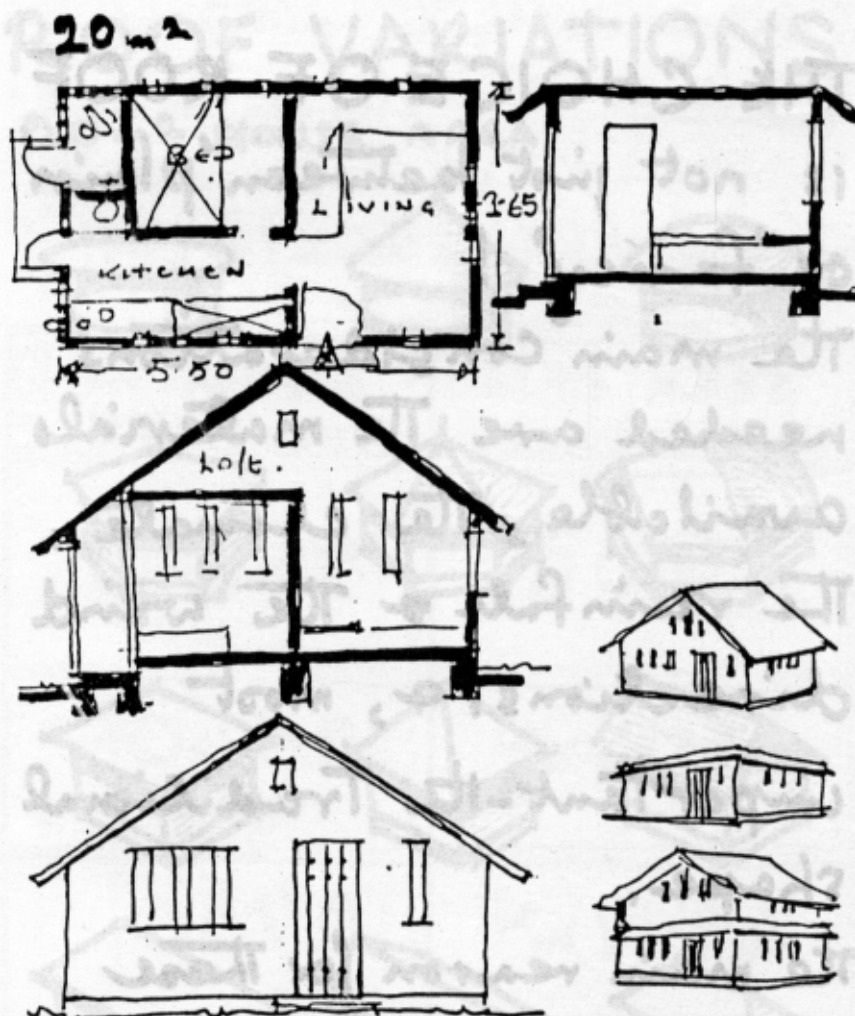
20m² HOUSE AREA



THE CHOICE OF ROOF
is not just between 'plain'
or 'fancy'!

The main considerations
needed are the materials
available, the climate,
the rainfall & the wind
directions, & most
important - the Traditional
shape.

The main reason for these
sketches is to show that a
community does not have to
have rows of identical
boxes.

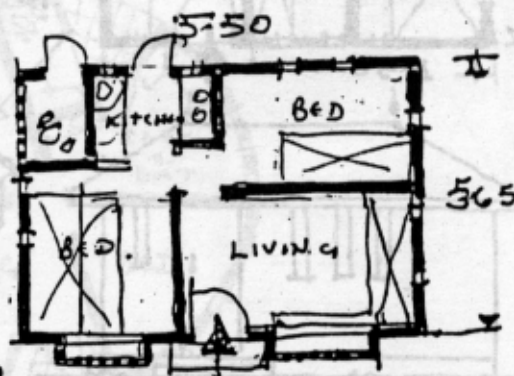
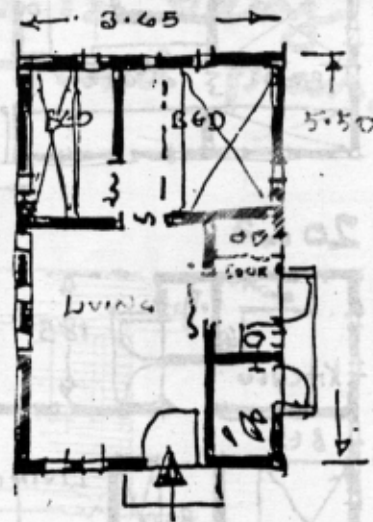
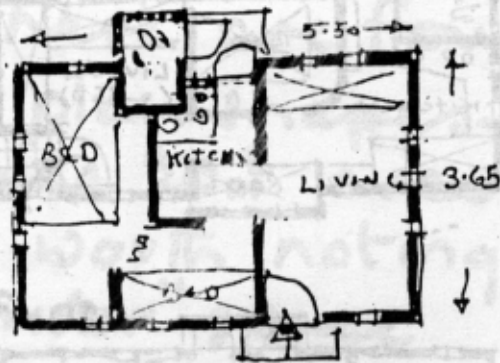


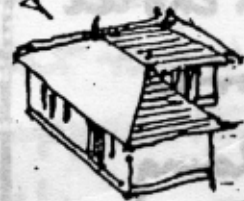
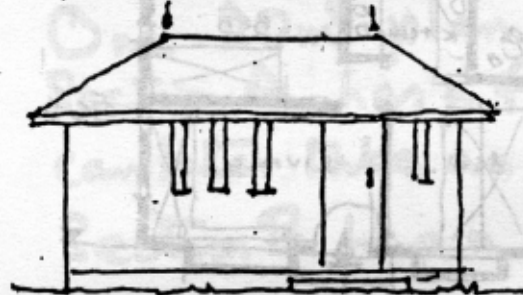
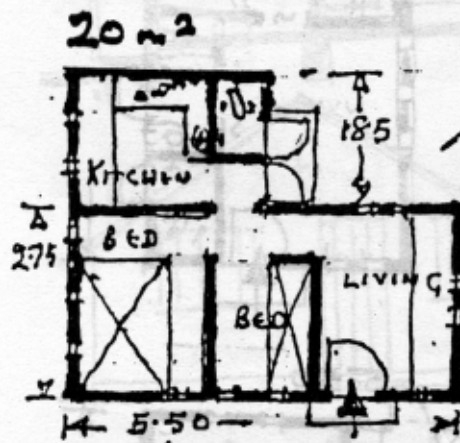
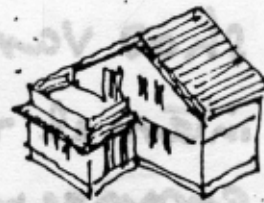
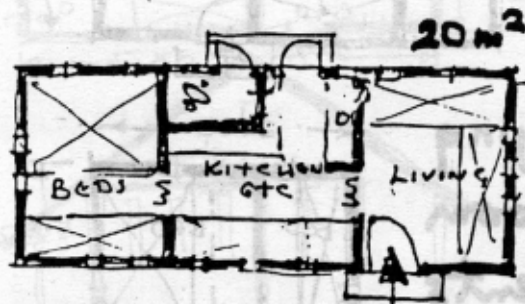
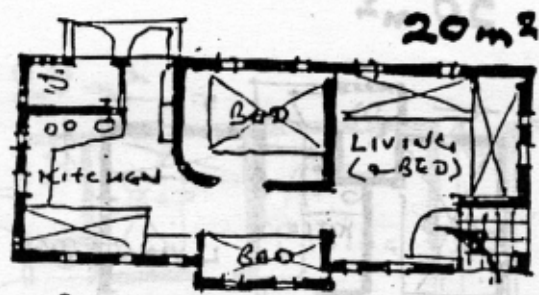
One 20m² plan - but
 Section A has a flat roof which
 can later take an upper storey.
 Section B has a sloping roof
 which allows room now for a loft.

There
3 plans
of a 20 m²
house
show varying
internal room
arrangements

Beneficiaries
should be
allowed to
make their
own choice
before
building
work starts.

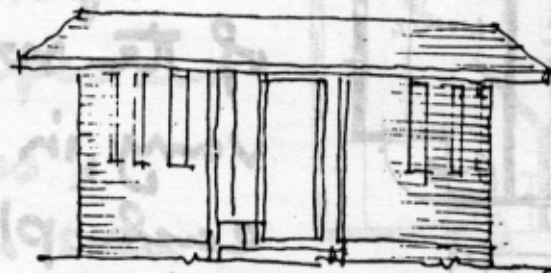
20 m²



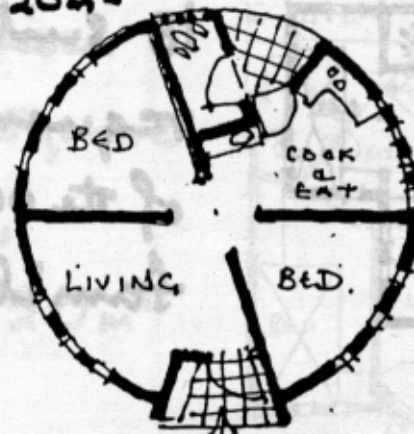


20 m²

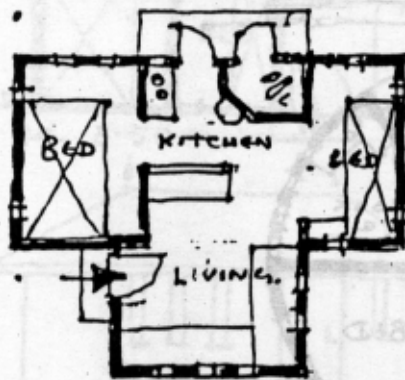
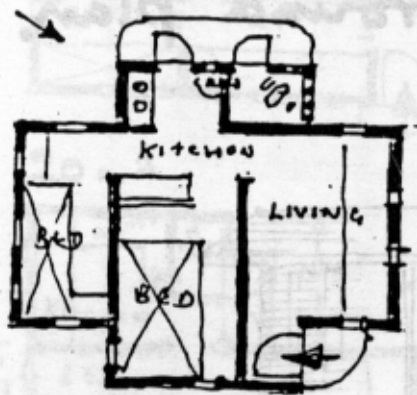
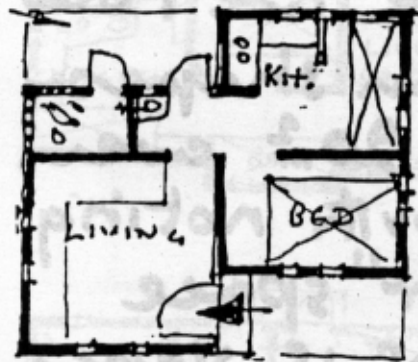
Again, here are four different plan shapes - but the same 20m^2 area. It is worth noting that "corridor" space between rooms is very small in the round plan.



20m^2

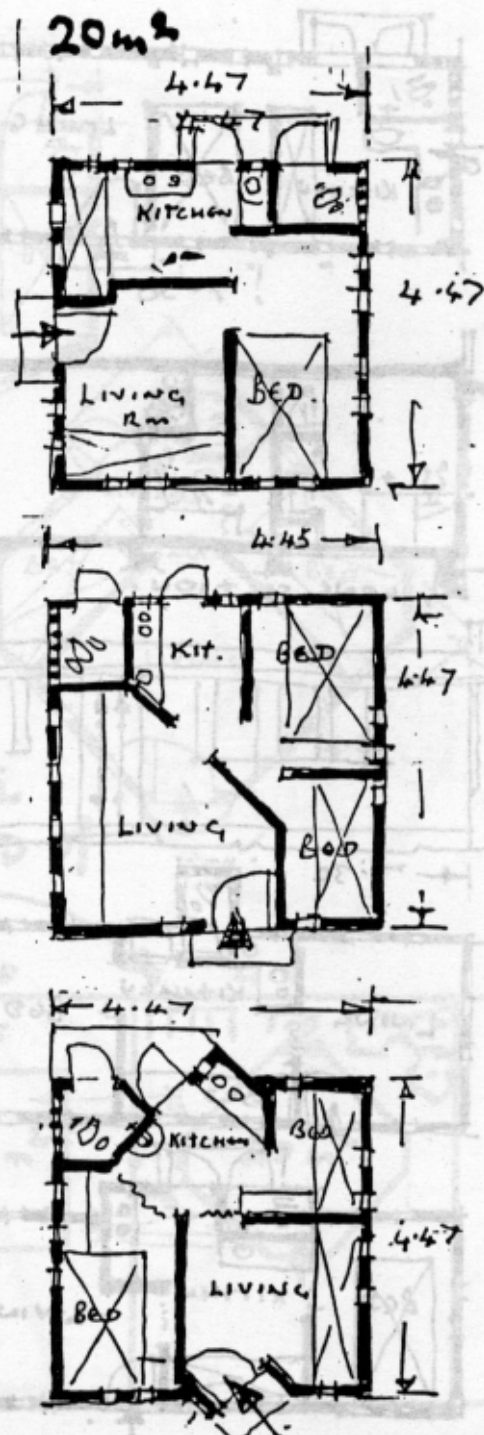


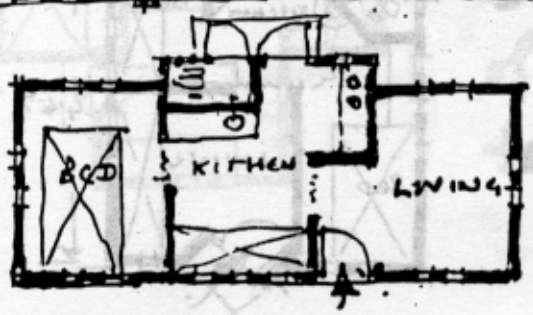
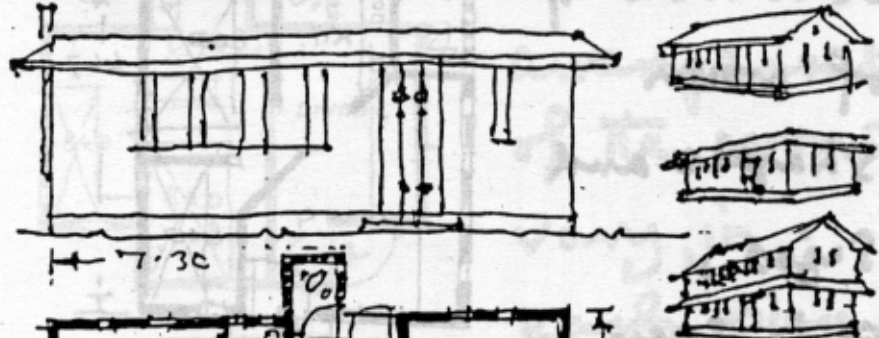
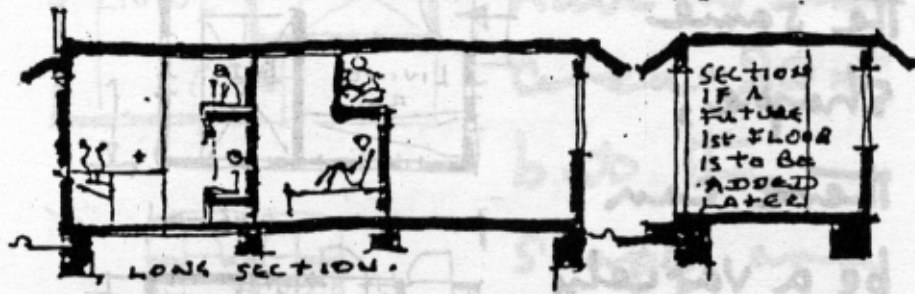
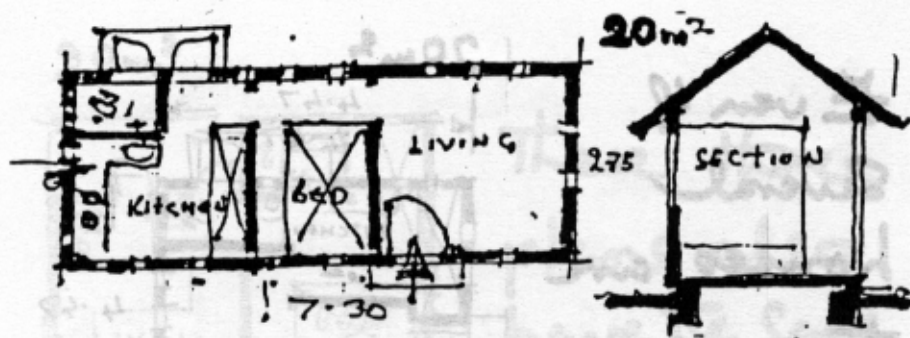
20m²



These three plans also have the same area - 20m², but the shape and arrangement of the rooms vary, in each plan, to suit the requirements of the occupying family.

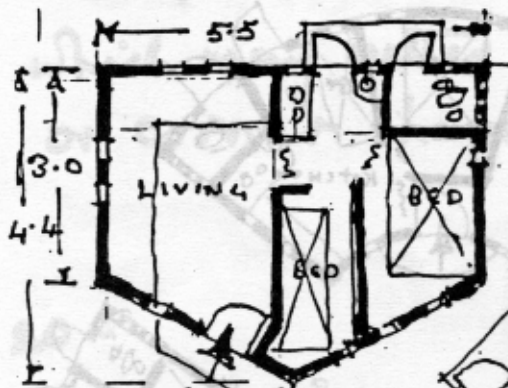
Even if
several
houses are
the same
shape,
there can
be a variety
of room
shapes and
sizes,
as is seen
with these
three square
plans,
each 20m^2



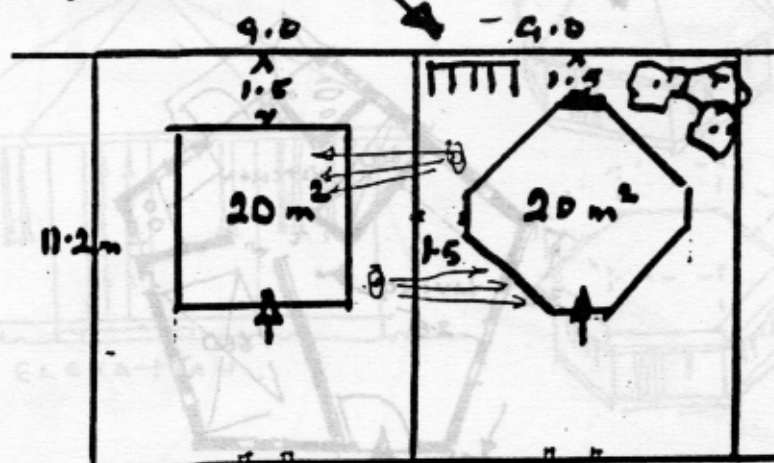
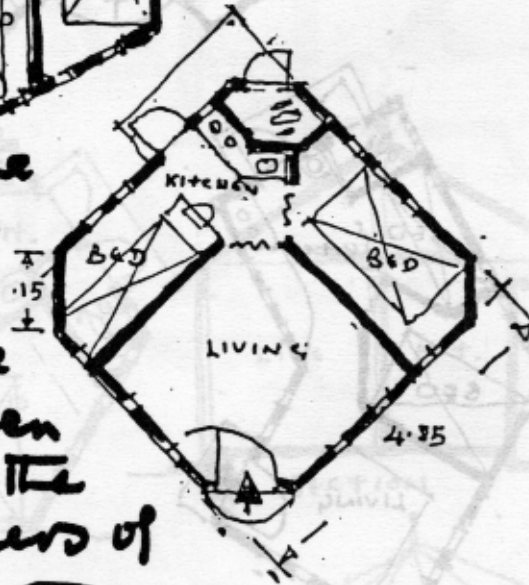


One shape
and size
but
various
room
arrangements.

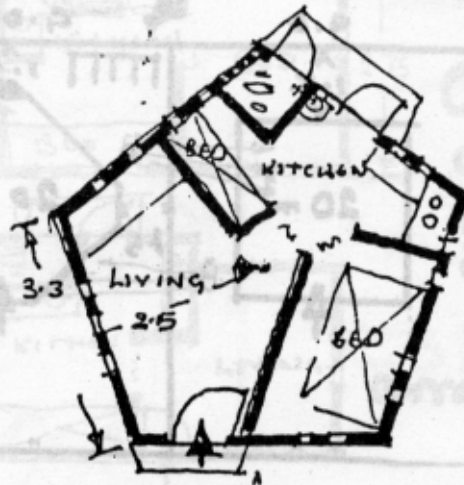
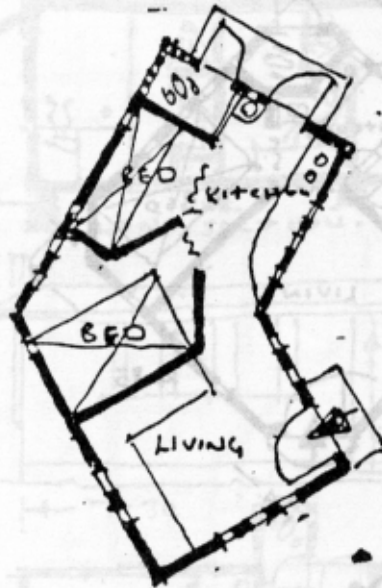
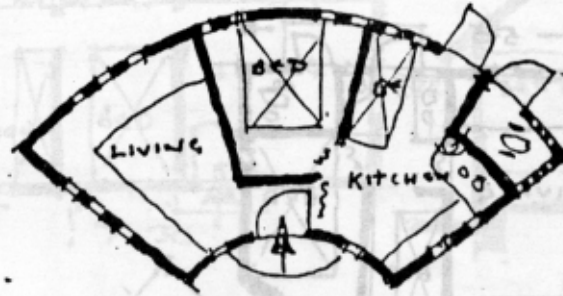
20 m²



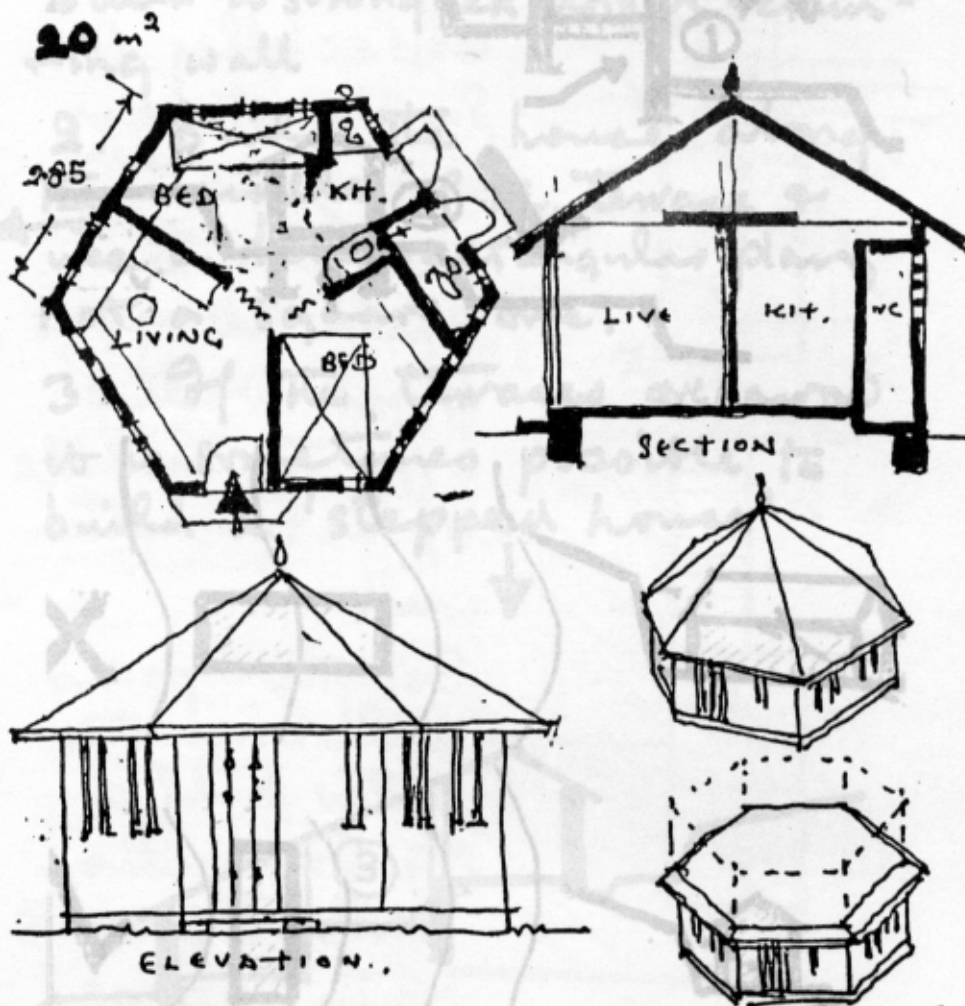
Turning the plan like this → gives more usable open spaces in the rear corners of the plot.



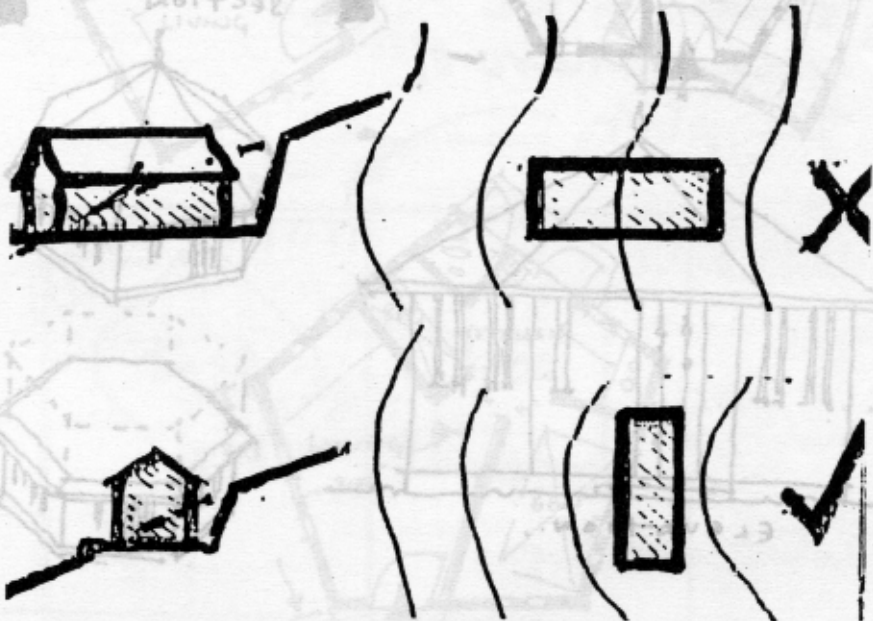
20 m²



These plans show odd shapes which may better fit into odd, or corner shaped plots.

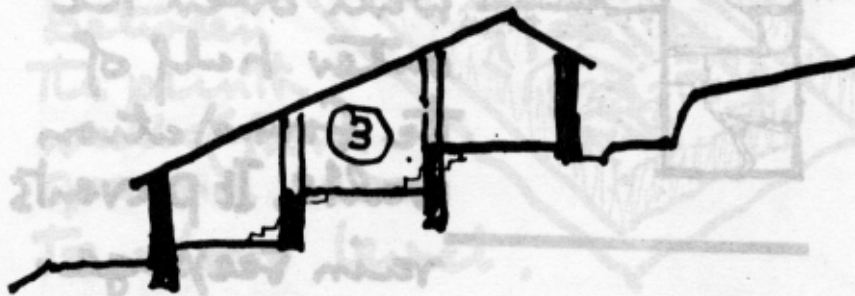


SLOPING SITES

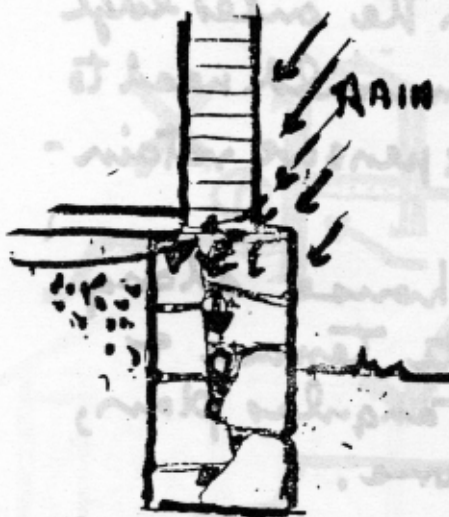


Where land is steeply sloping,
or terraced -

1. Don't build on the outer edge
of the terrace. You would need to
build a strong expensive retain-
ing wall.
2. Build the house along
the middle of the terrace &
use a long rectangular plan,
not a square one.
3. If the terraces are narrow
it is sometimes possible to
build a 'stepped house'.

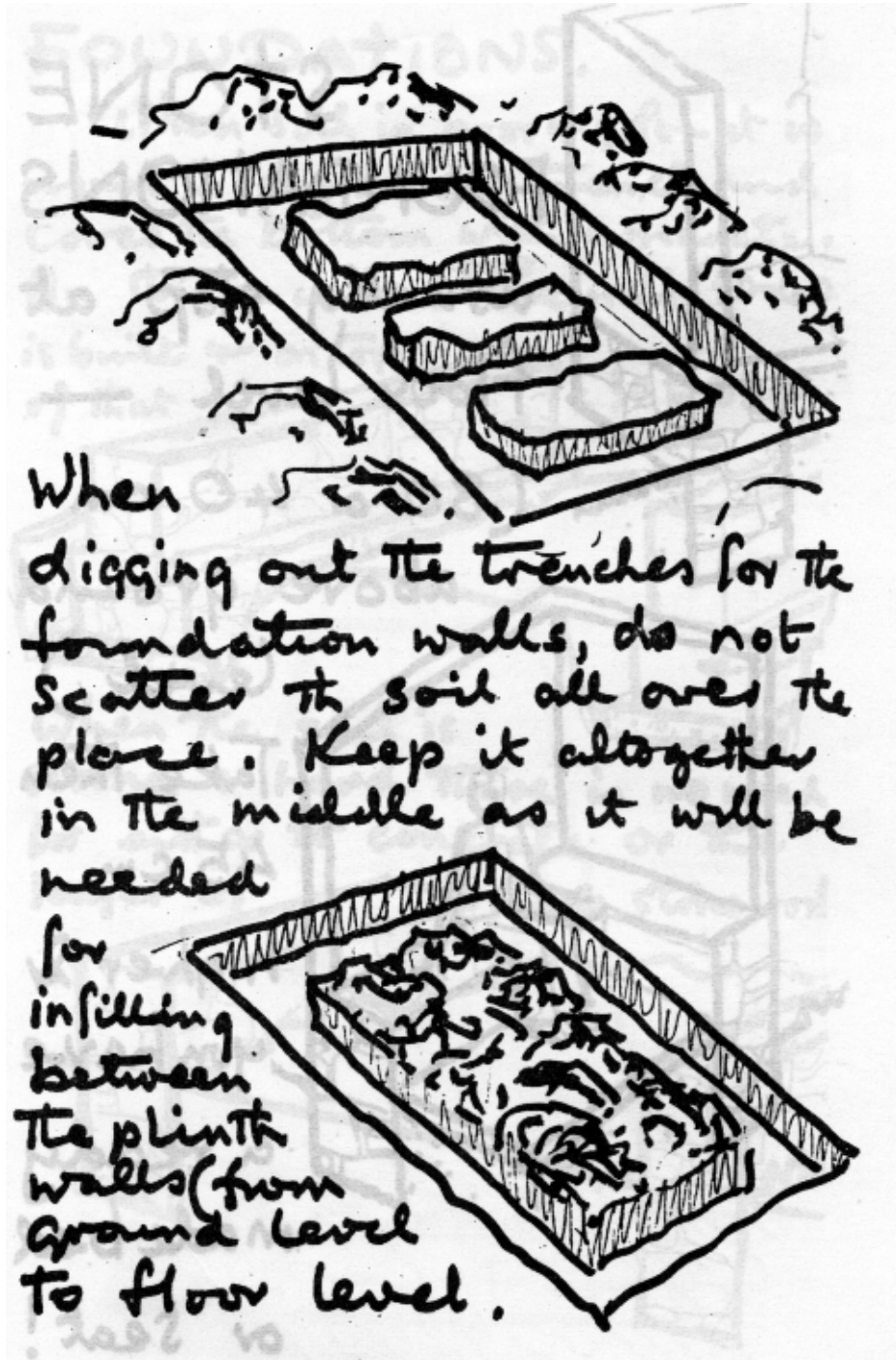


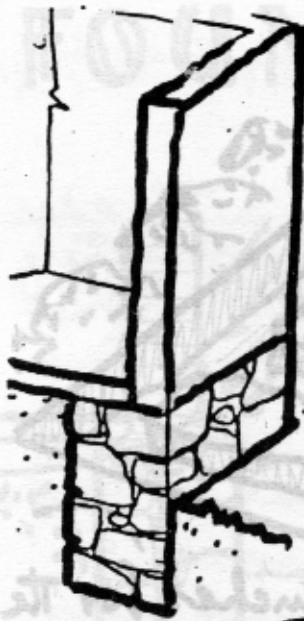
FOUNDATIONS



For small houses (and especially for single storey ones) there is no need to build the upper brick walls over the middle of the foundation wall.

Set the upper wall over the outer half of the foundation walls. It prevents rain seepage.

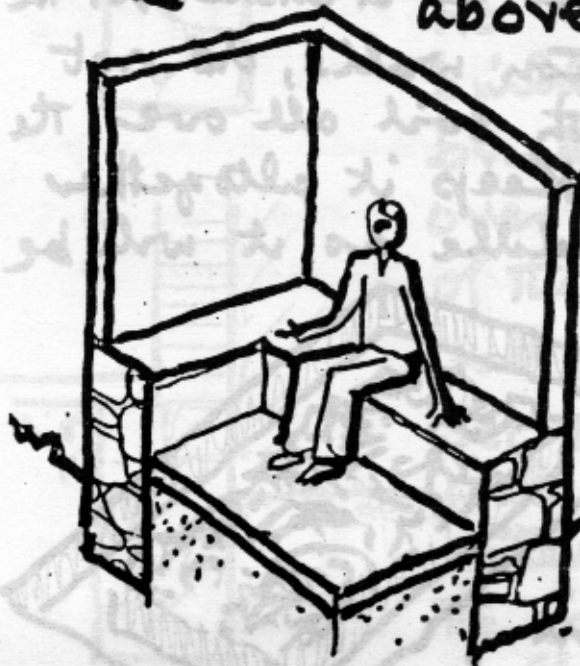




STONE FOUNDATIONS

usually stop at floor level —

(30 or 40 cm above ground level.)



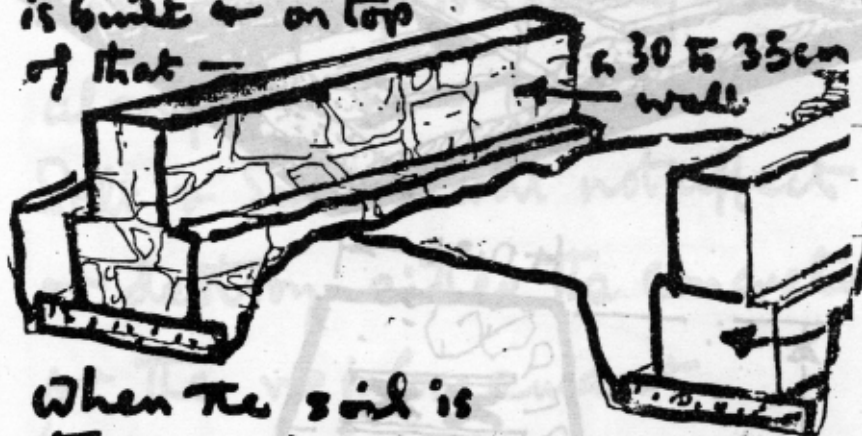
Take them 45 cm

higher & you have

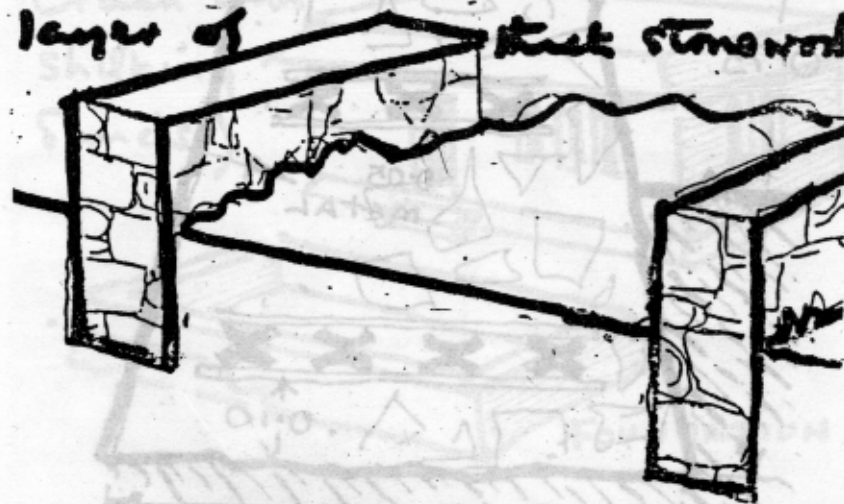
a ready made bed or seat!

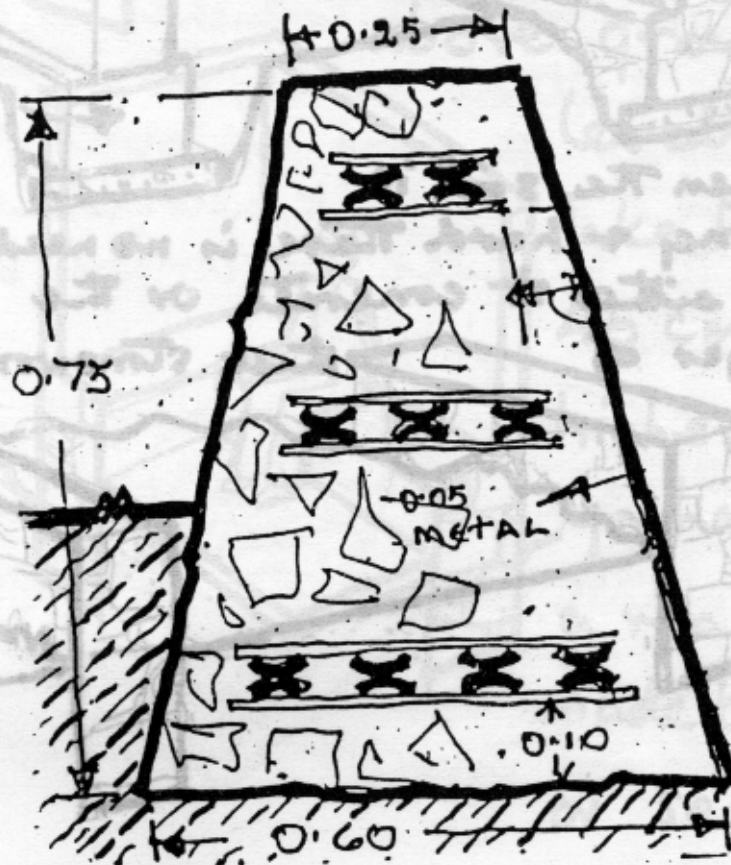
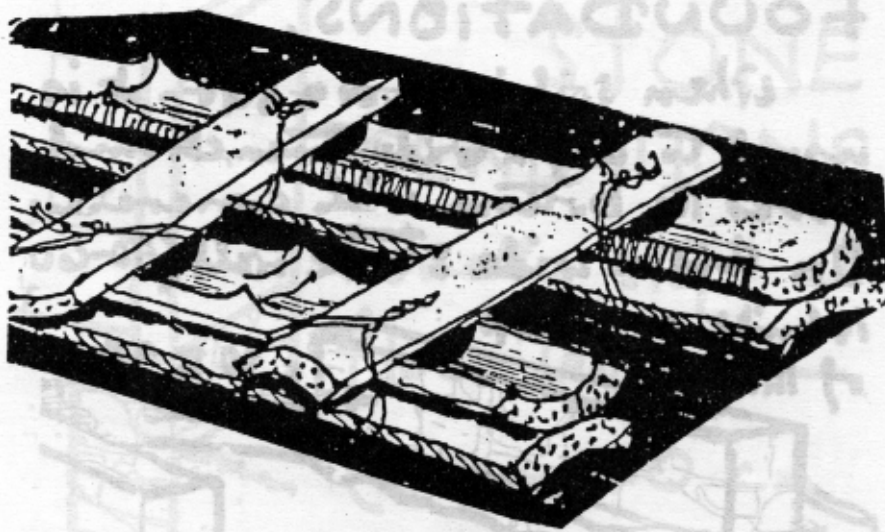
FOUNDATIONS.

When soil is poor & soft - it is usual to dig a wide trench and cover the bottom with concrete. On this a wide stone wall (50-60) is built & on top of that -



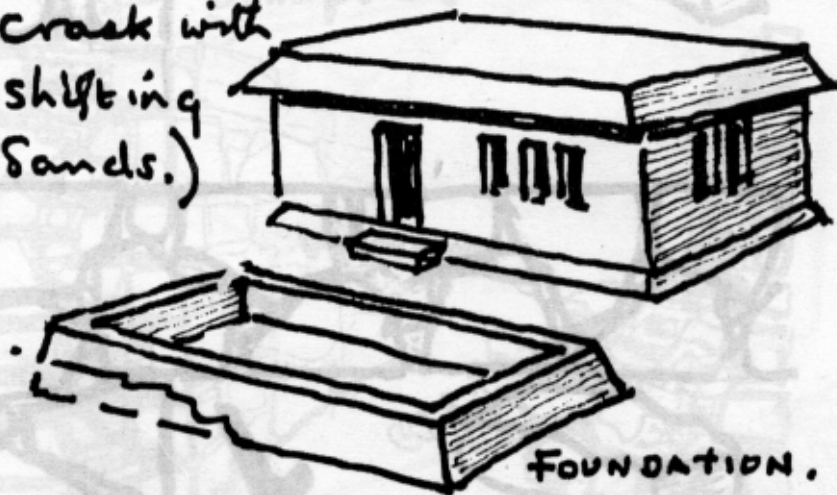
When the soil is strong & hard there is no need for either the concrete or the layer of

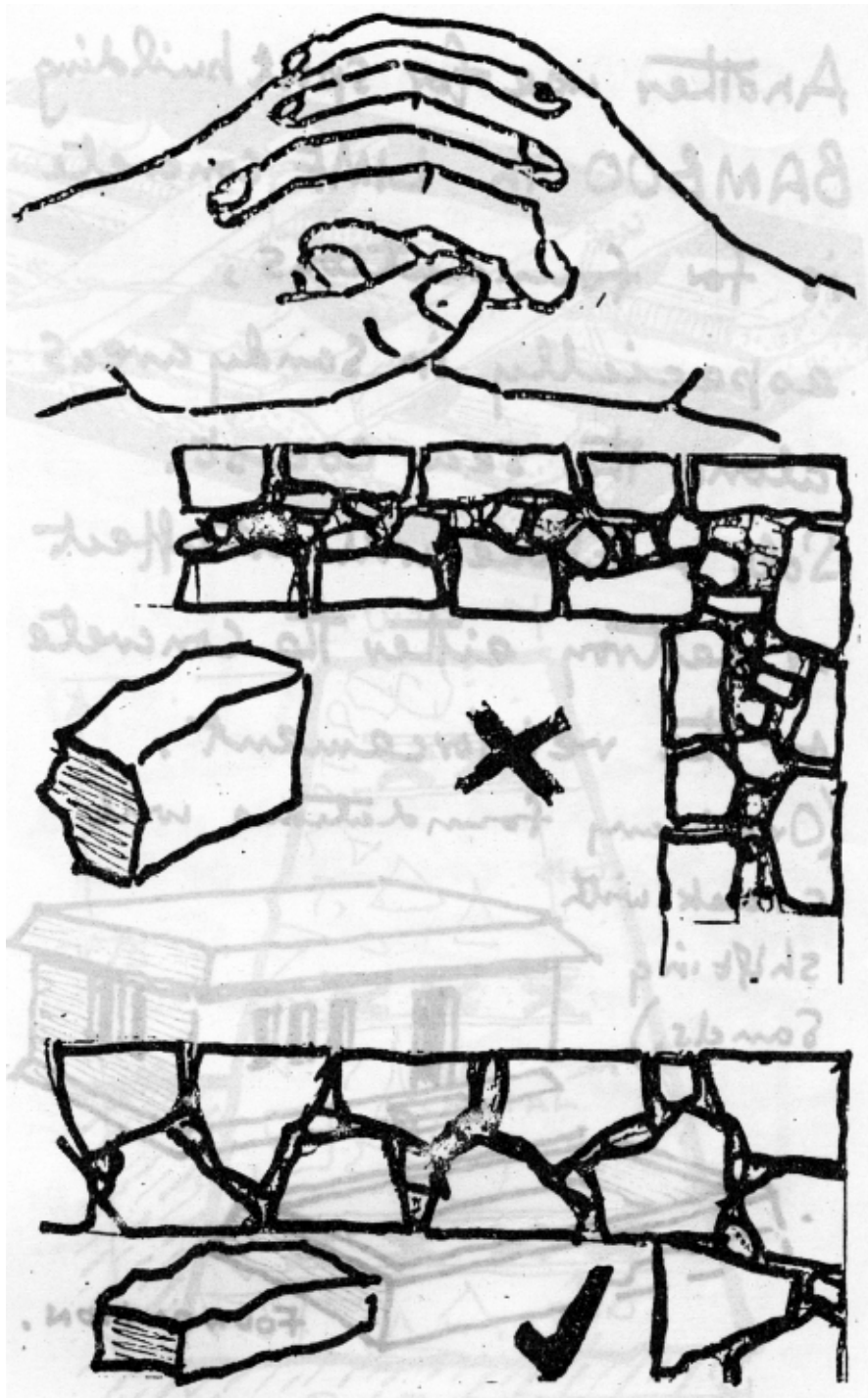




Another use for split building
BAMBOO in LIME concrete
is for foundations,
especially in sandy areas
along the sea coast.
Salt & Saline will not affect
or destroy either the concrete
or the reinforcement.

(Ordinary foundations will
crack with
shifting
sands.)

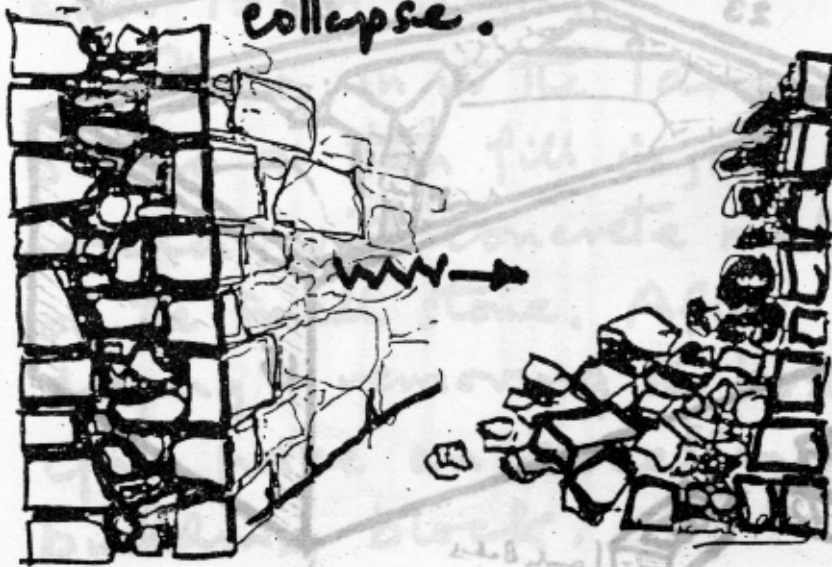


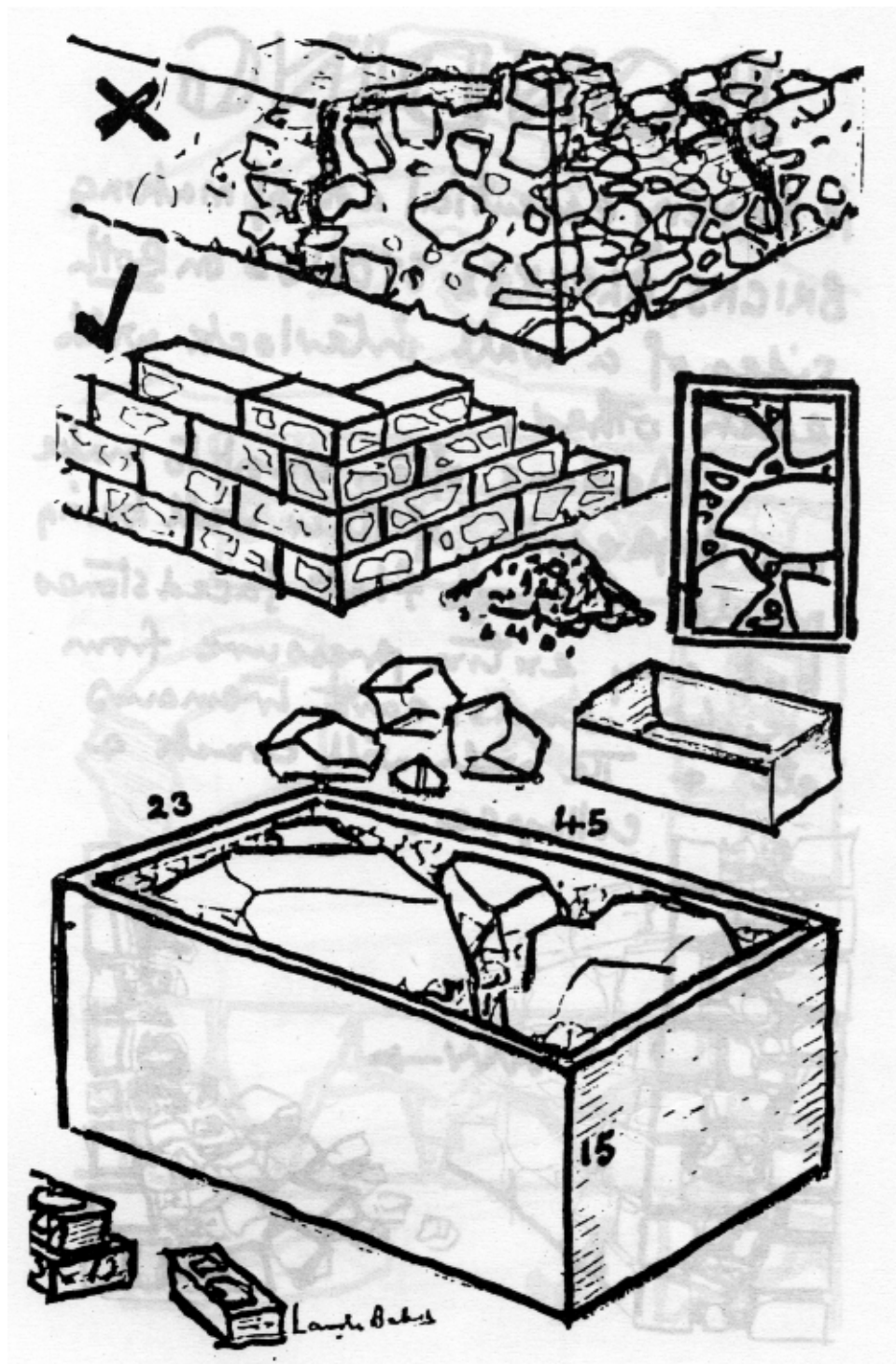


BONDING

is the very essential art of making BRICKS, BLOCKS & STONES on Both sides of a wall interlock with each other.

Masons often want to make an impression of Their wall being made of large flat faced stones but any extra pressure from weight, winds, earth tremours etc & The wall will crack & collapse.

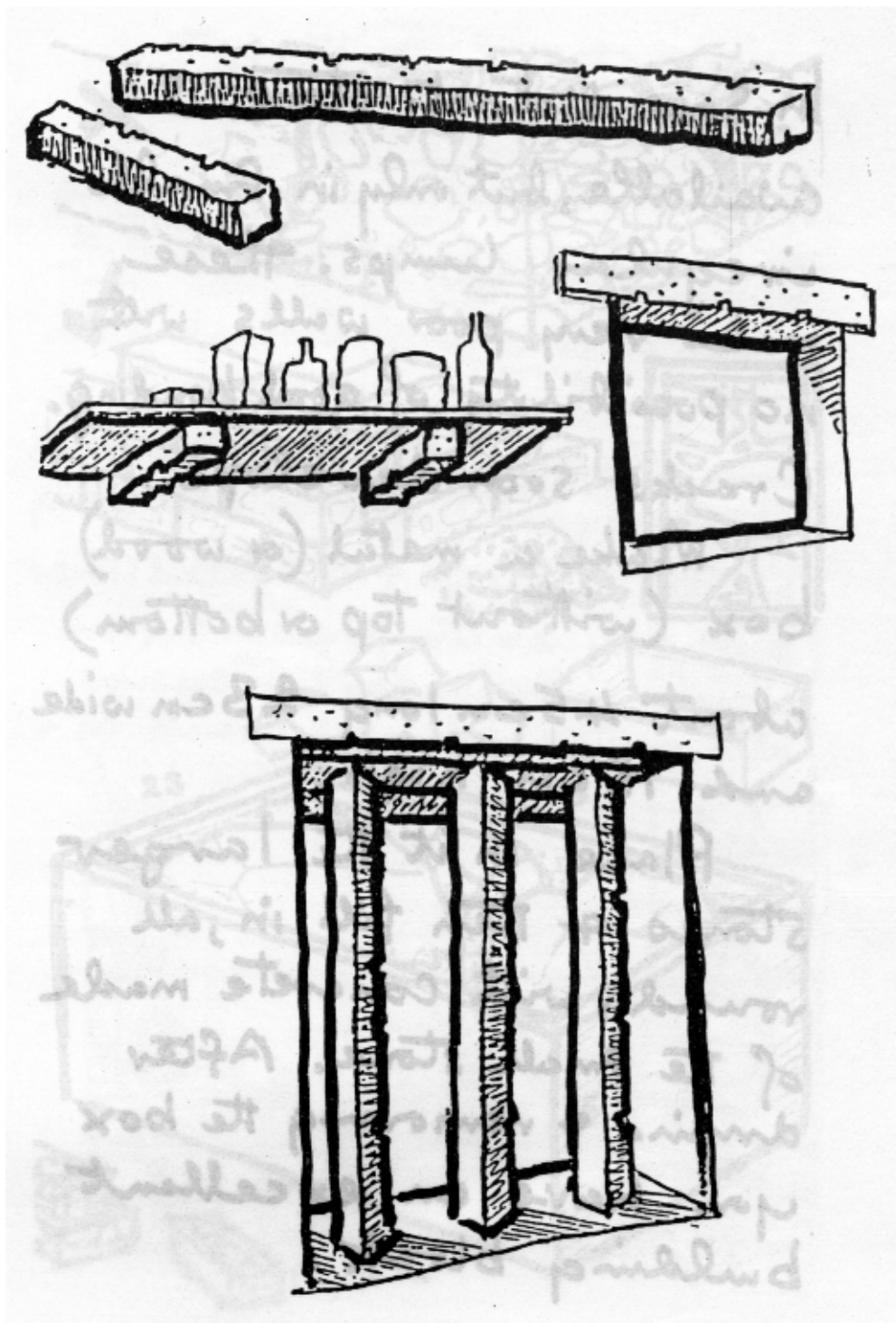




In some districts stone is available, but only in small irregular lumps. These make very poor walls with no possibility of good bonding. Cracks soon develop.

Make a metal (or wood) box (without top or bottom) about 45 cm long, 23 cm wide and 15 cm high.

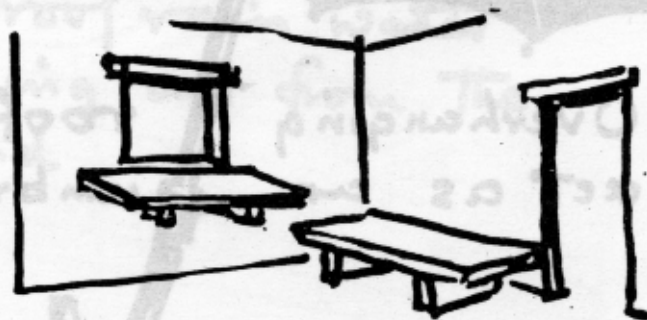
Place in it the larger stones & then fill in, all round, with concrete made of the small stone. After drying & removing the box you have an excellent building block.



SPLIT STONE

In some districts granite is split from large rocks to give posts & slabs.

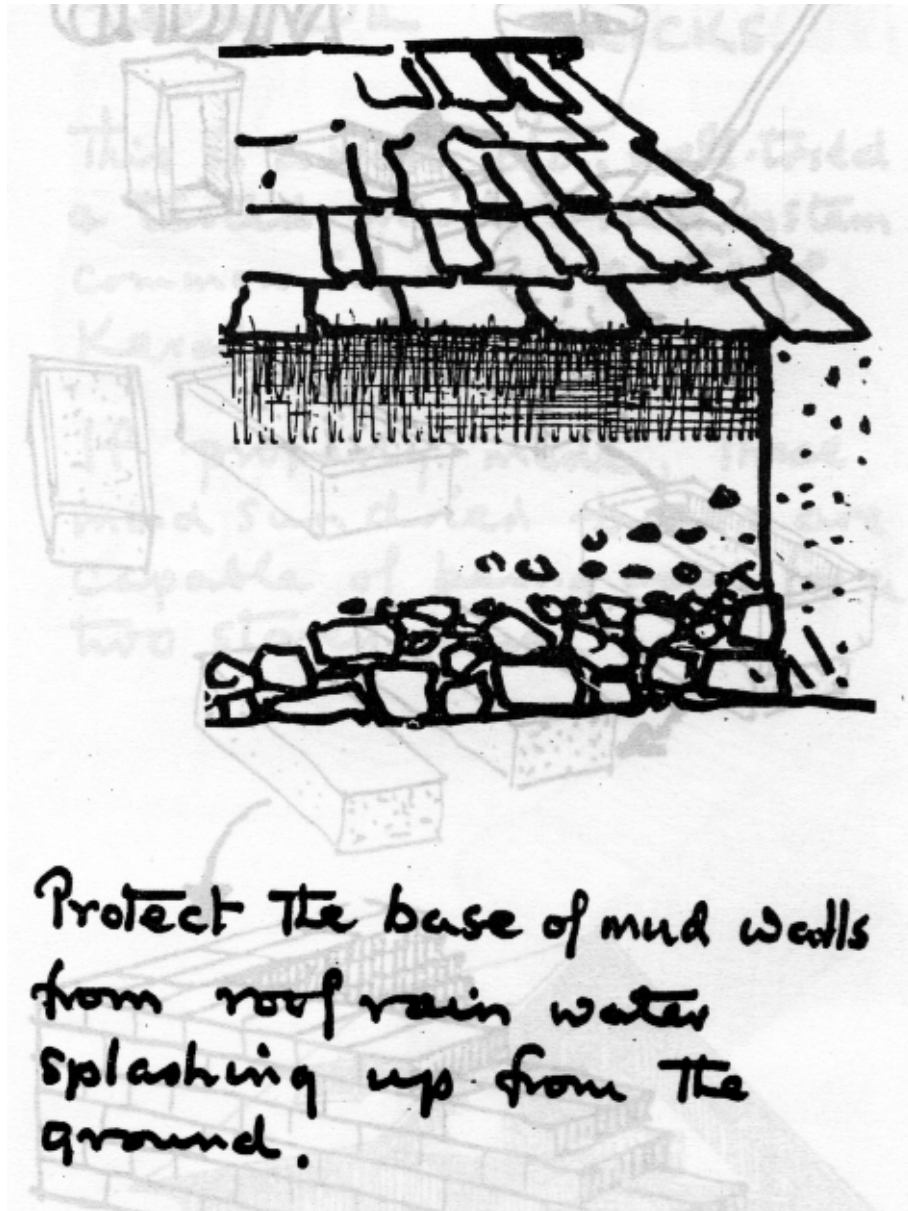
You can incorporate these stones as lintels, shelves, window 'grills' and child-proof furniture. Short broken posts can usually be had at very low prices.



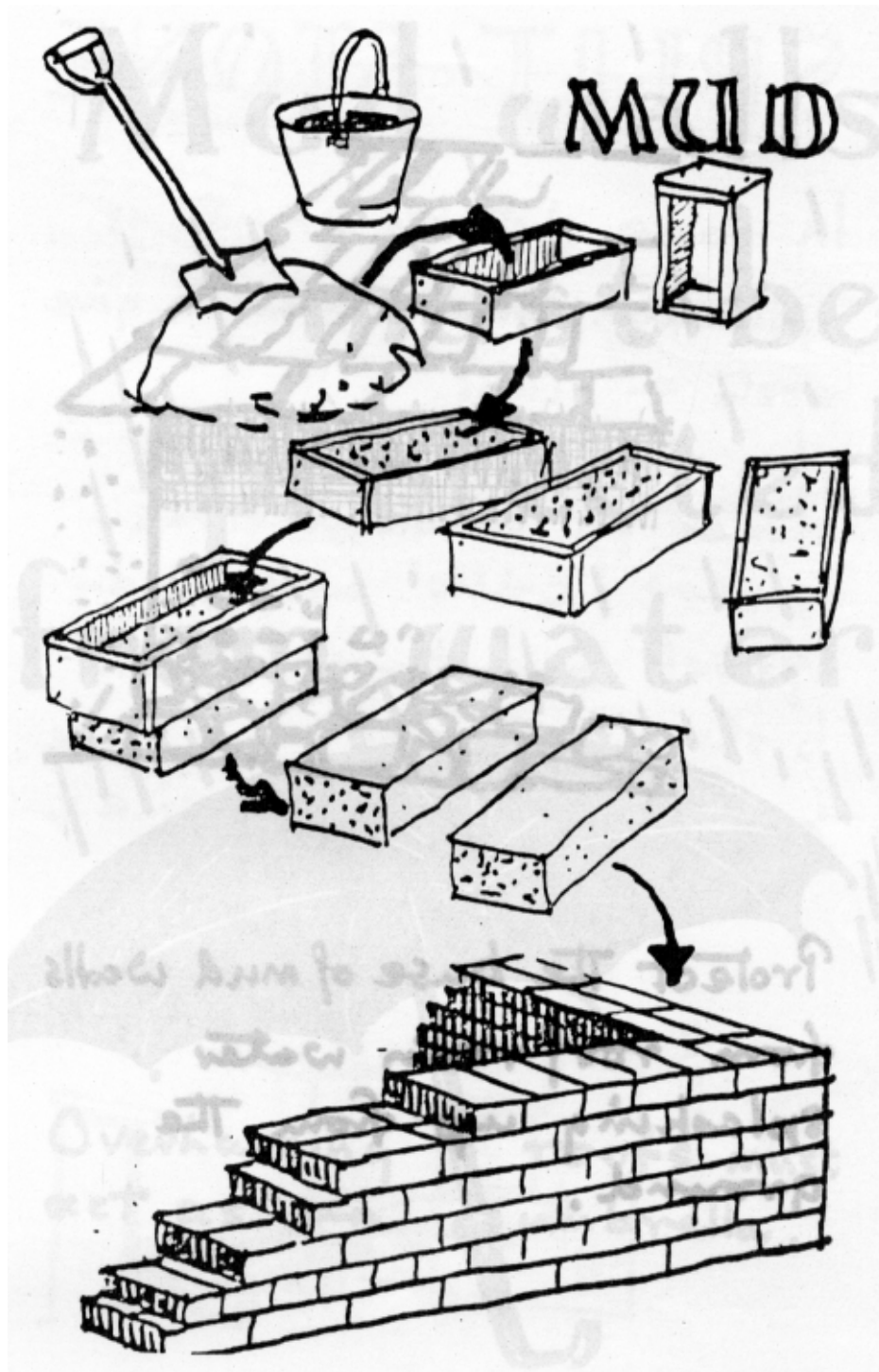
Mud walls
must be
protected
from water



Overhanging roofs must
act as an umbrella.



Protect the base of mud wells
from roof rain water
splashing up from the
ground.



ADOBE OR SUN DRIED BRICKS.

This is a very old, well-tried & tested mud brick system common in many parts of Kerala.

If properly made, These mud sun dried bricks are capable of being used for a two storey house.



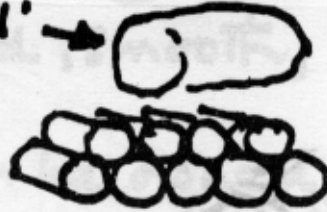
MUD



COB

Mix soil with only a little water — pick up as much as you can in your two hands and make a 'roll' →

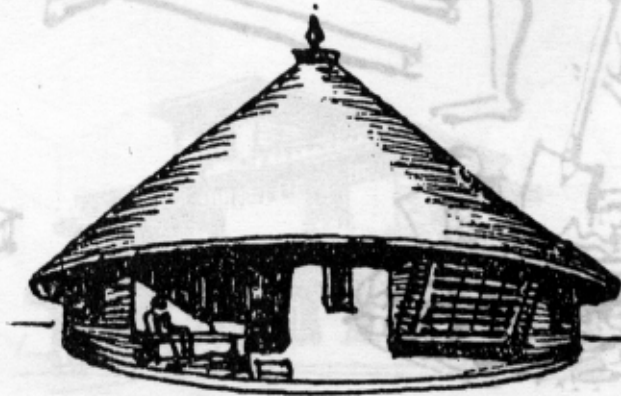
Place these rolls closely together in rows.



Then Smooth over the ends.

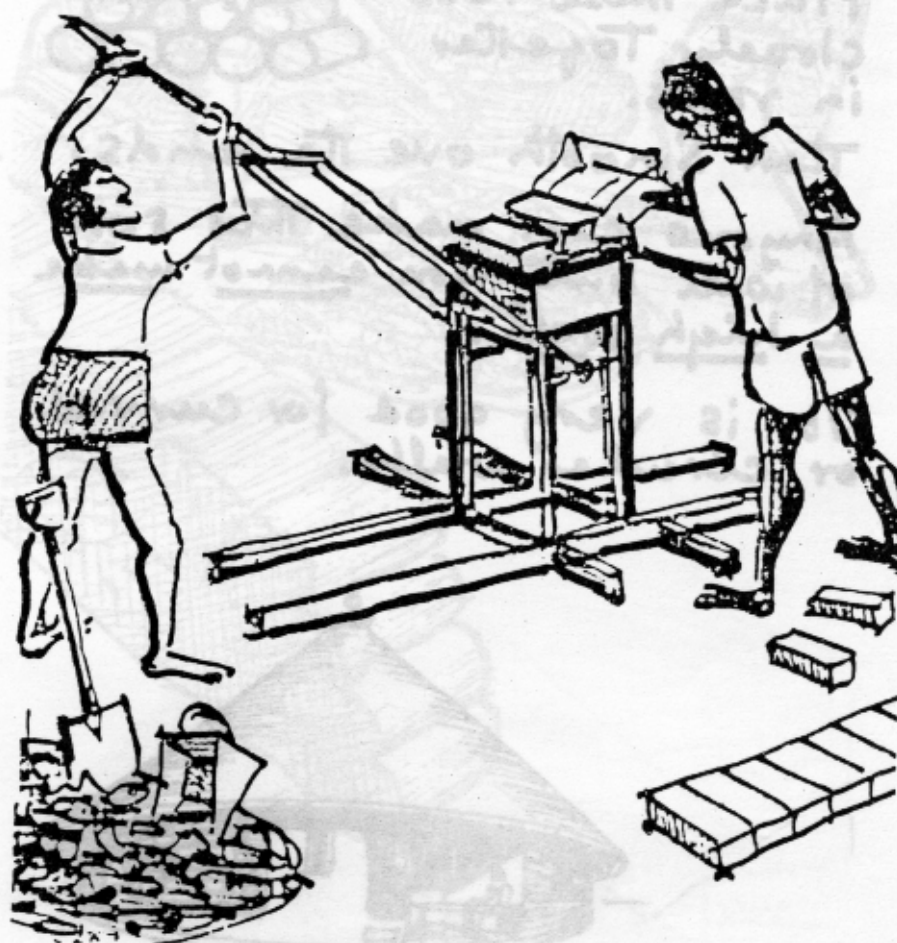
Anyone can make this sort of wall but you cannot make a high wall.

It is very good for curved or circular walls.



MUD

COB

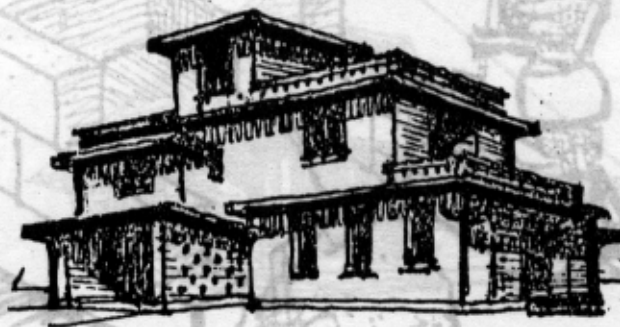


PRESSED BRICKS

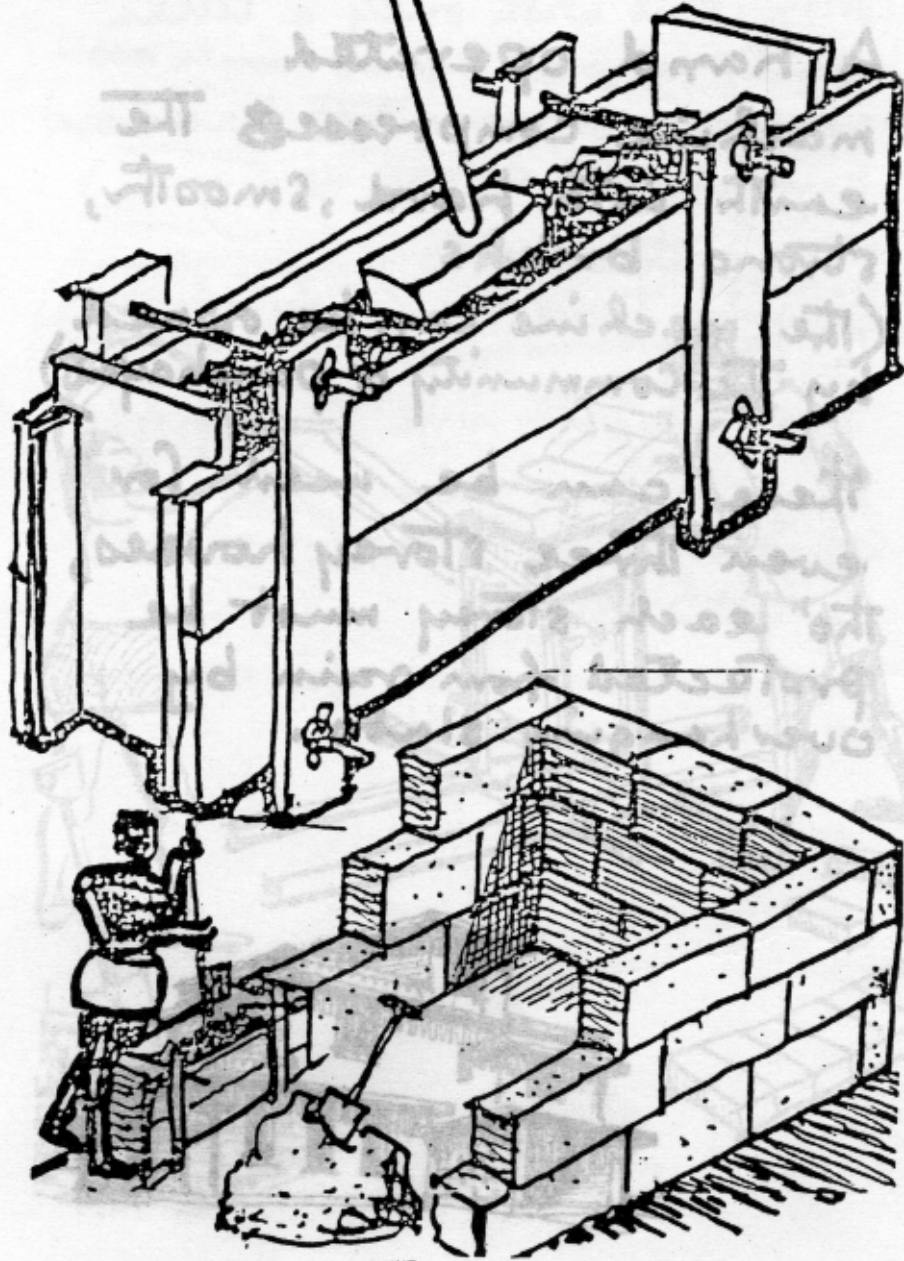
A hand operated machine compresses the earth into hard, smooth, strong bricks.

(The machine can be owned by the community or panchayat)

These can be used for even three storey houses, tho' each storey must be protected from rain by overhanging slabs.



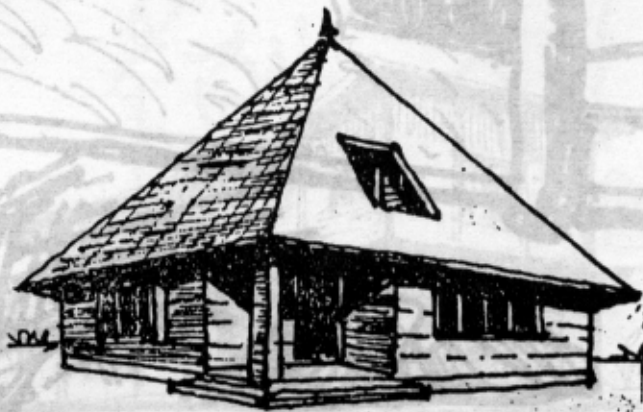
MCID



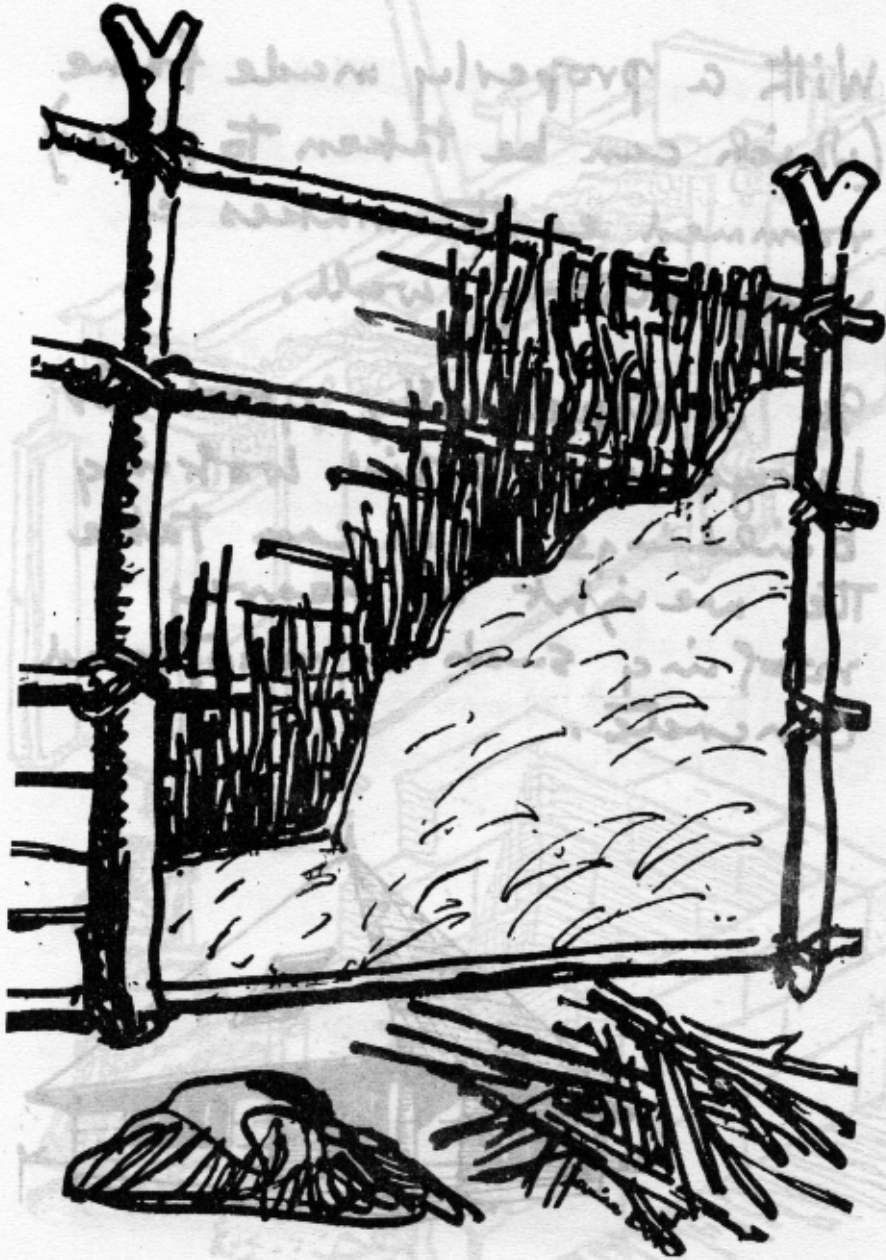
PISE (RAMMED EARTH)

With a properly made frame (which can be taken to pieces) rammed earth makes a very strong wall.

It is especially good for large, low, solid looking buildings & it can take the weight of heavy roofing such as reinforced concrete.



MUD



WATTLE & DAUB

This system of using mud for house building is more usual in India's Eastern States.

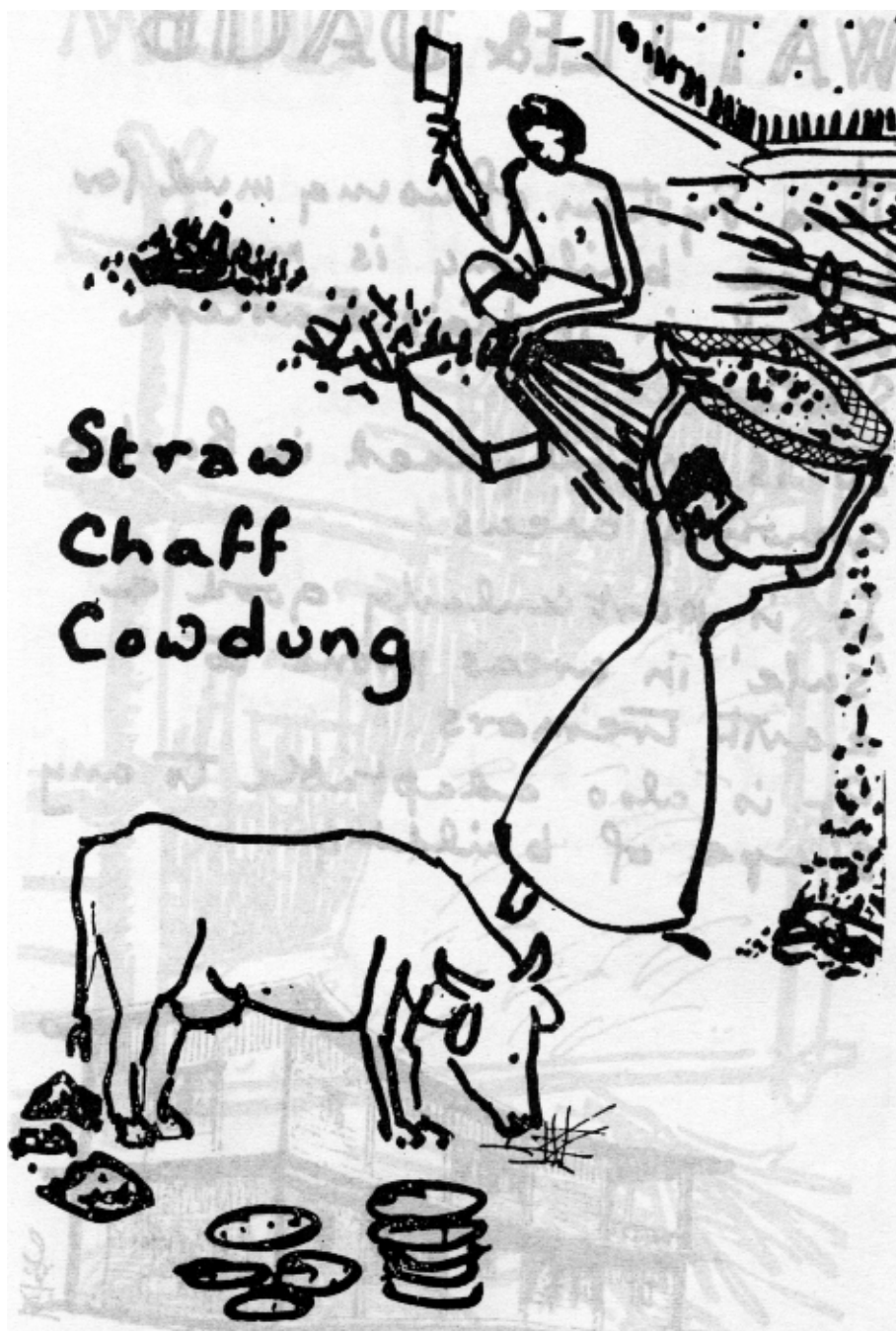
It is mainly used in Bamboo growing areas

It is particularly good & 'safe' in areas prone to earth tremors

It is also adaptable to any shape of building



Straw
Chaff
Cowdung



Rural stabilisers



sisal
cacti
etc.

plant
juices

LATERITE

Lateite is found in many parts of Kerala (& in other states too). It is a natural, compressed earth & uses no energy (fuel) at all.

Unfortunately, unlike Soil & Sand, once 'mined', the quarry remains as a big hole in the ground.

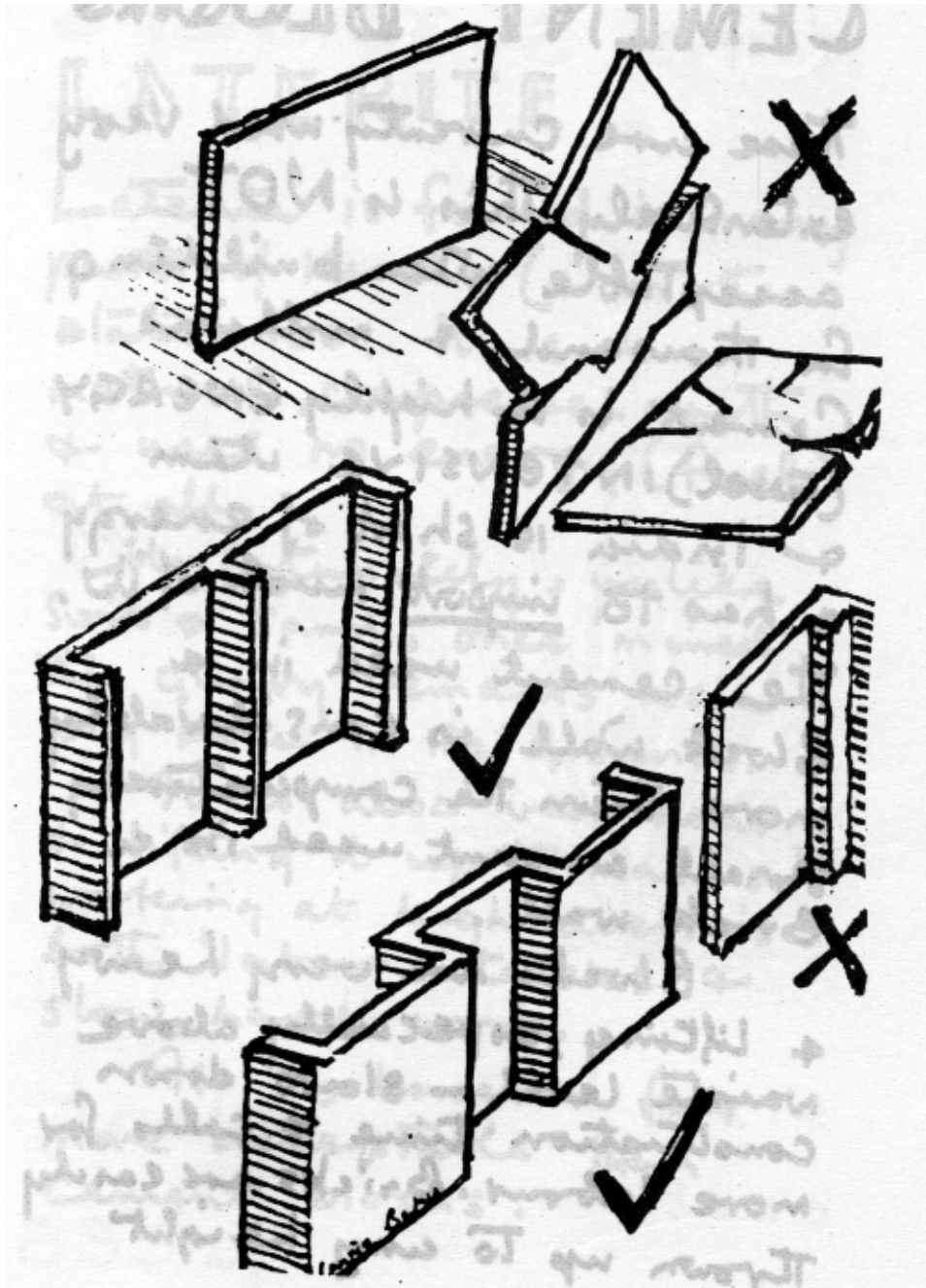
It is also very heavy & lifting it up to masons working at high levels is both 'labour intensive' & slow, hard work.

It is, however, far more acceptable than cement blocks.

CEMENT BLOCKS

These are currently used very extensively. This is NOT acceptable when building for thousands & millions. Cement is a highly ENERGY (Fuel) INTENSIVE item & India is short of energy & has to import much of it. The cement used in a Block wall is considerably more than the comparatively small amount used in a Brick wall.

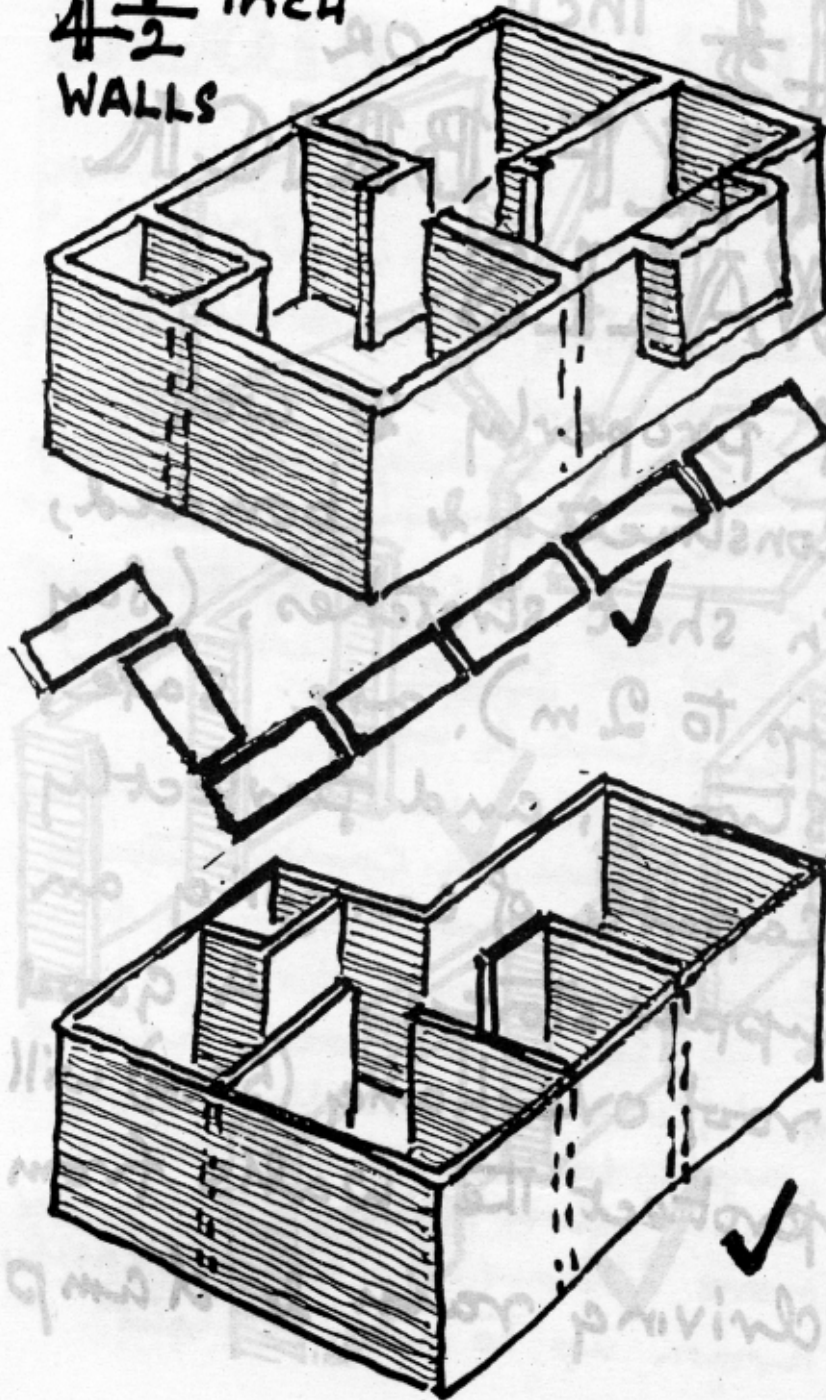
Blocks are very heavy & lifting, especially above waist level - slows down construction time & calls for more labour. Bricks are easily thrown up to any height.



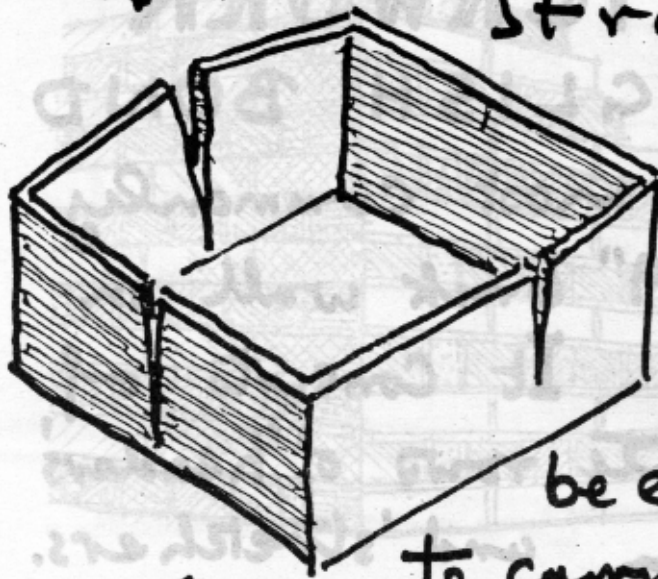
4½ INCH OR HALF BRICK WALLS

if properly & well constructed & bonded, in short stretches, (say up to 2m), are safe, strong, and perfectly capable of carrying an upper storey. A good roof overhang (50cm) will protect the walls from driving rain & damp.

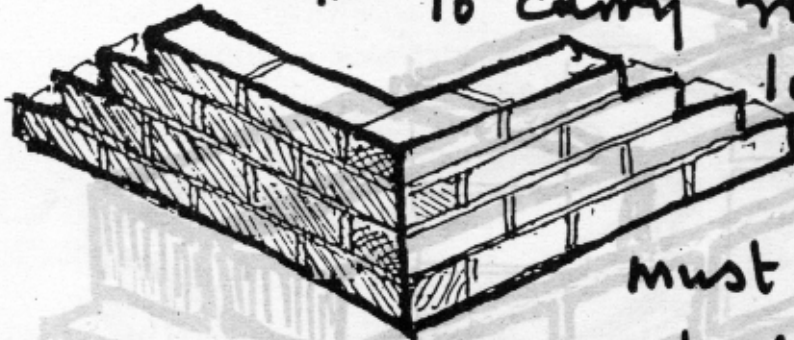
$4\frac{1}{2}$ INCH
WALLS



X



Straight,
Long,
thin
walls
cannot
be expected
to carry roof
loads.



&
must be
expected to
bulge, crack
& break, if
not well
planned.

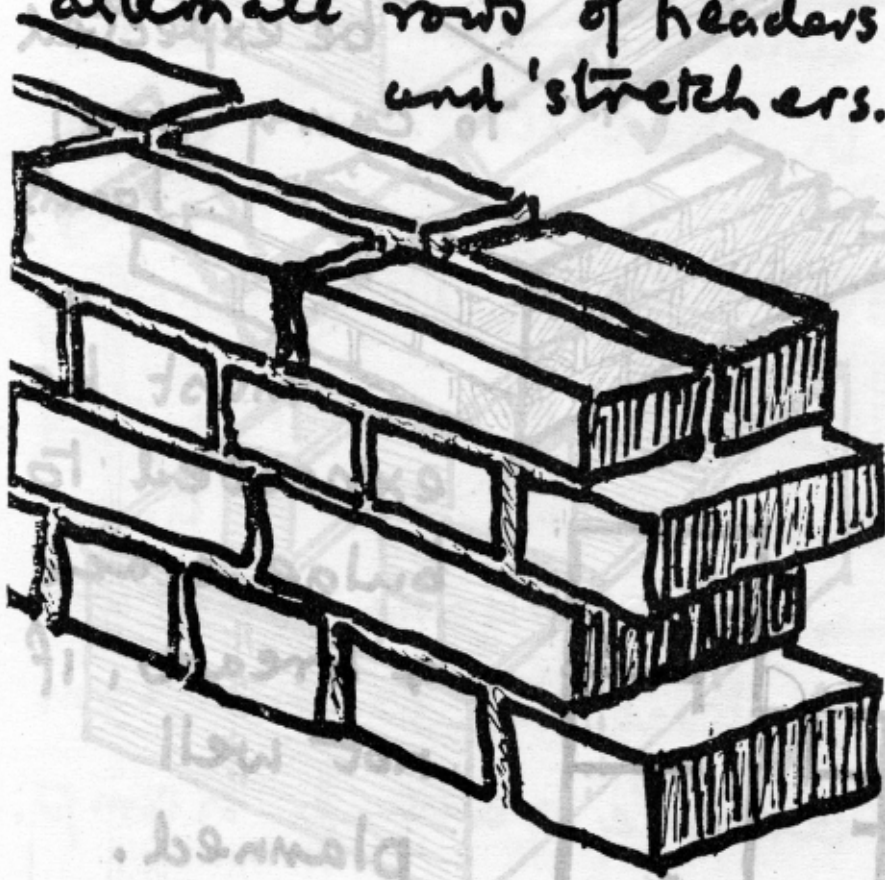


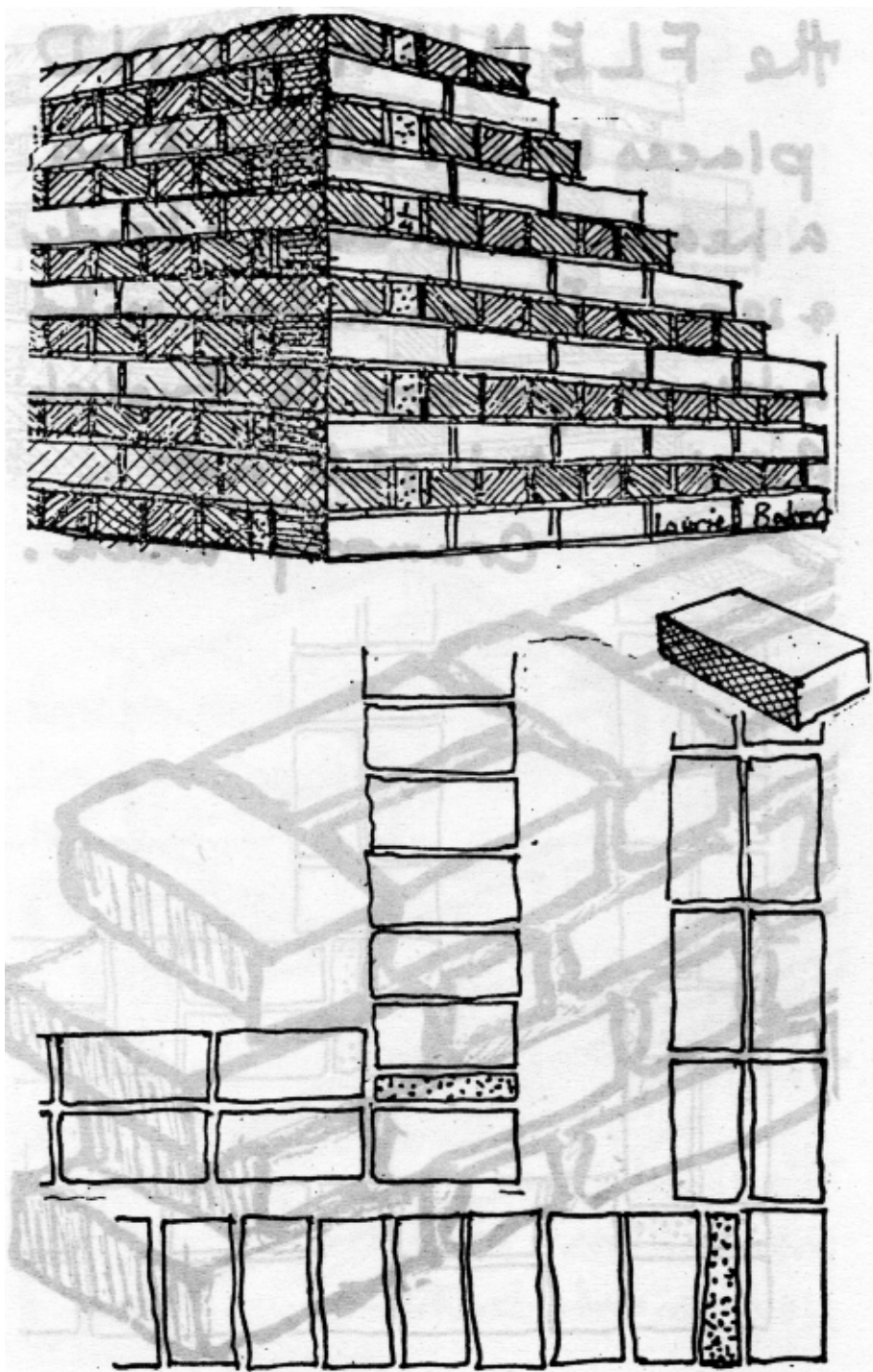
BRICKWORK

The ENGLISH BOND

was the most commonly
used 9" brick wall in

India. It consists of
alternate rows of 'headers'
and 'stretchers'.

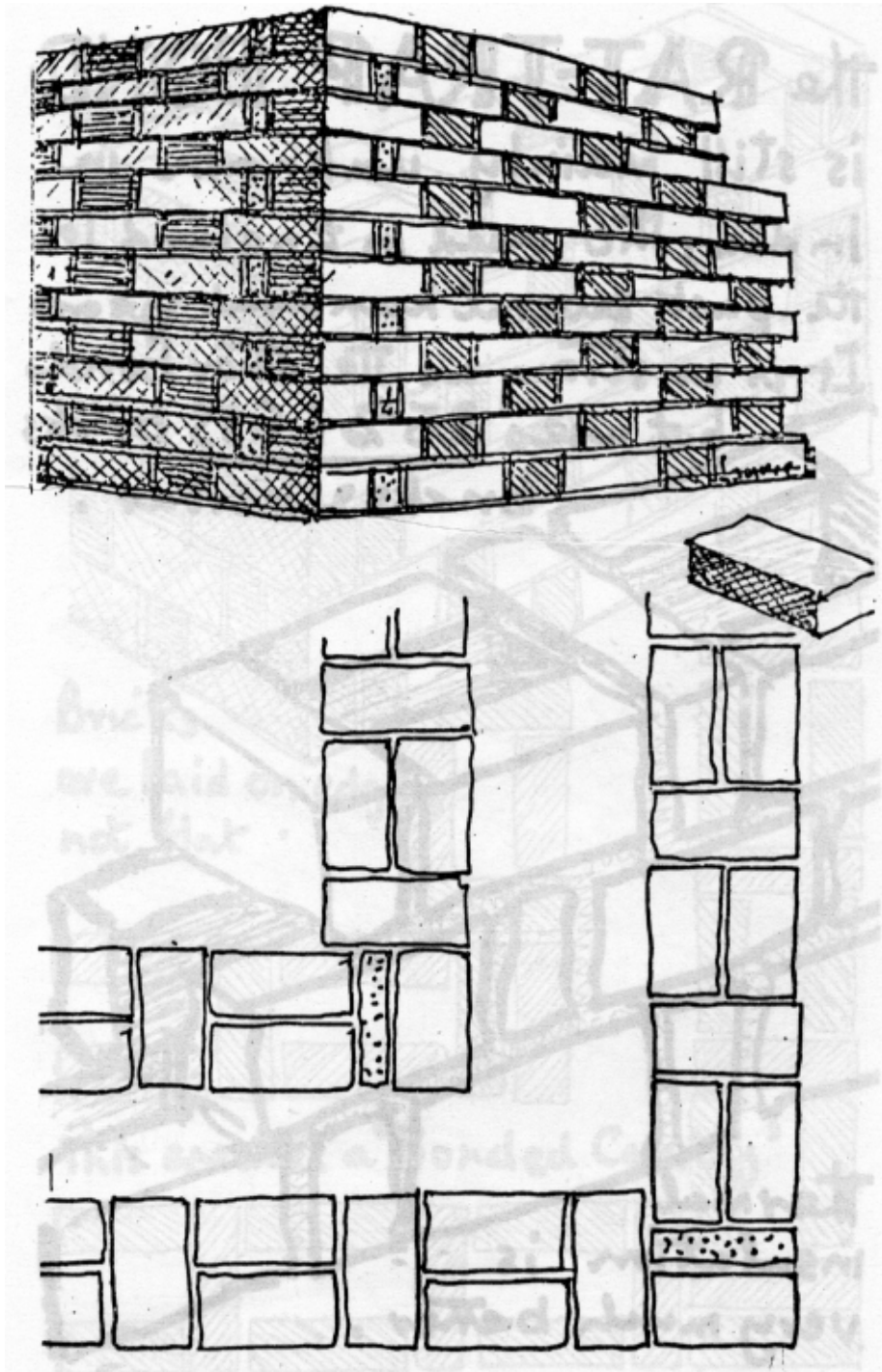




the FLEMISH BOND

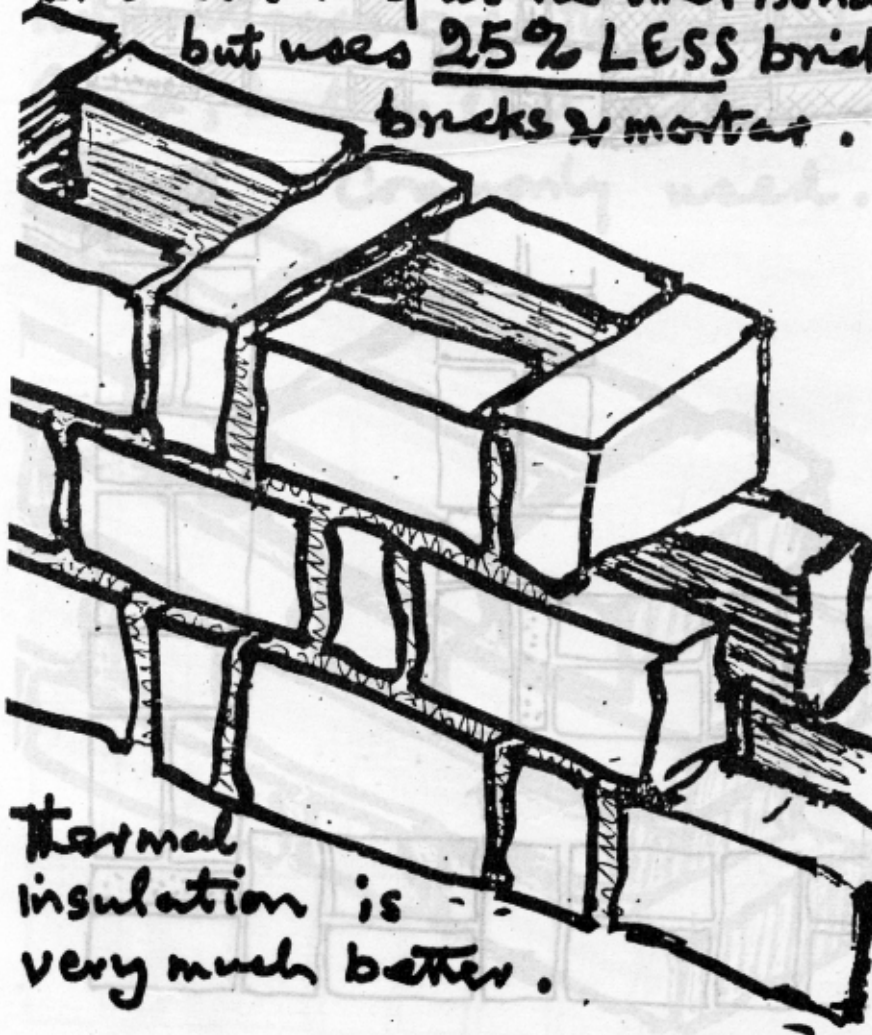
places bricks alternating
a header, a stretcher, a header
& so on. It has a few mild
advantages over the English
Bond, but is still not
commonly used.



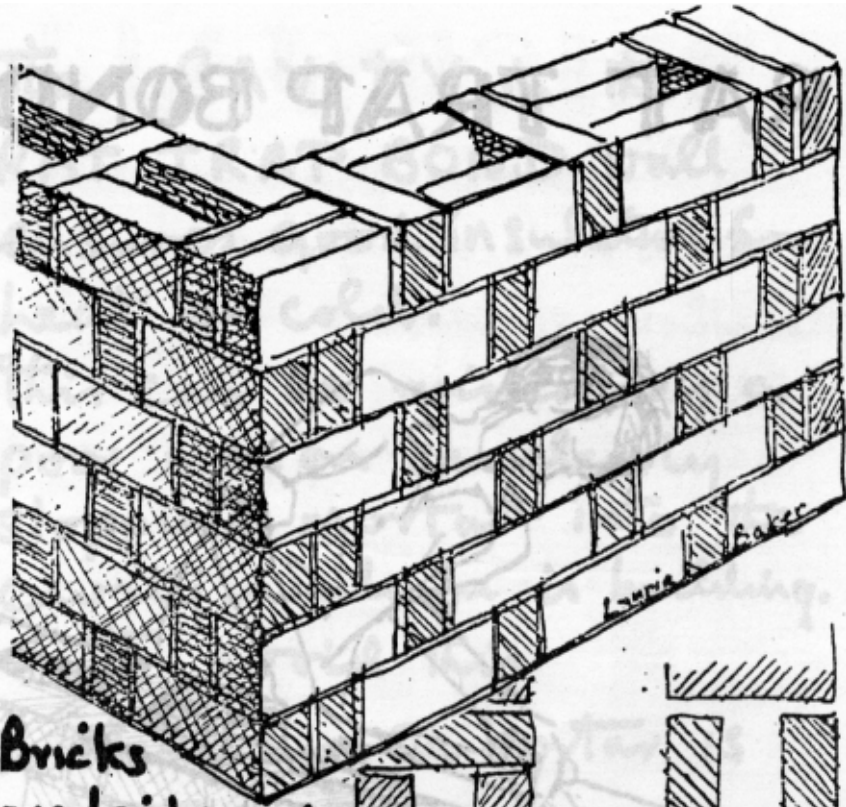


the RAT-TRAP BOND

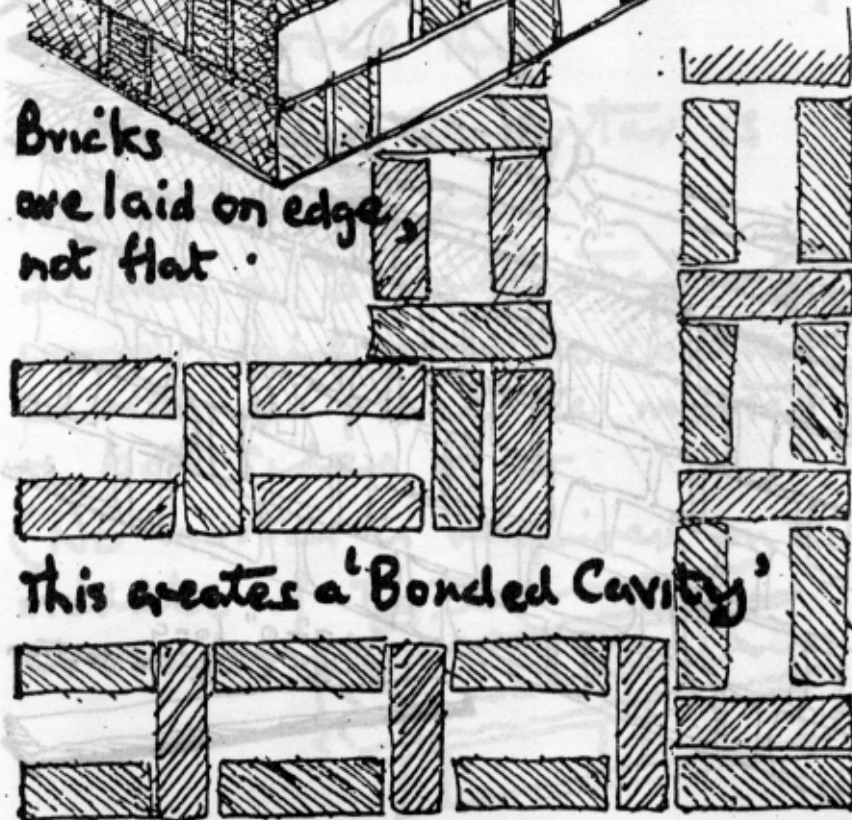
is still mainly unknown in India, tho used in England for the past several hundred years. It is as strong as the other bonds but uses 25% LESS bricks & mortar.



Thermal insulation is very much better.

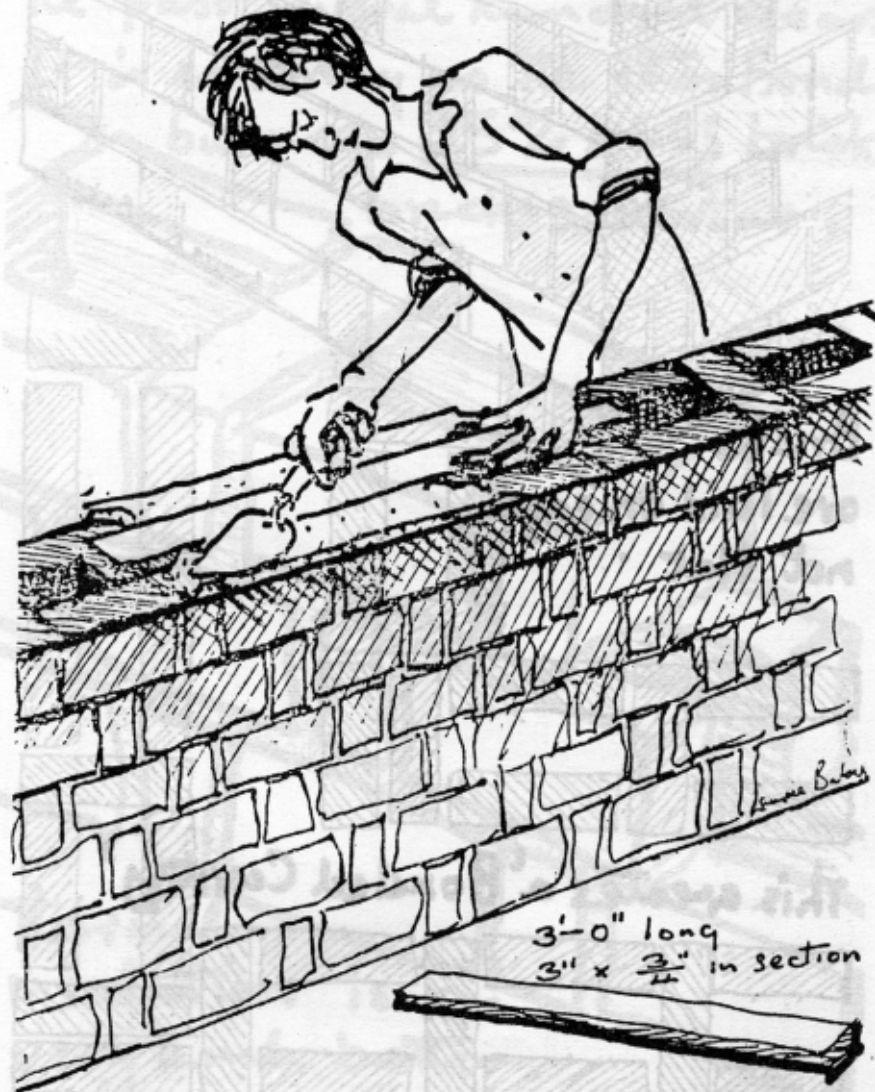


Bricks
are laid on edge,
not flat.



This creates a 'Bonded Cavity'

RAT TRAP BOND



The CAVITY in the RAT TRAP BOND wall ensures good insulation from heat & cold.

This can be ruined by a poor mason carelessly slopping mortar into the cavity while he is building.

To avoid this

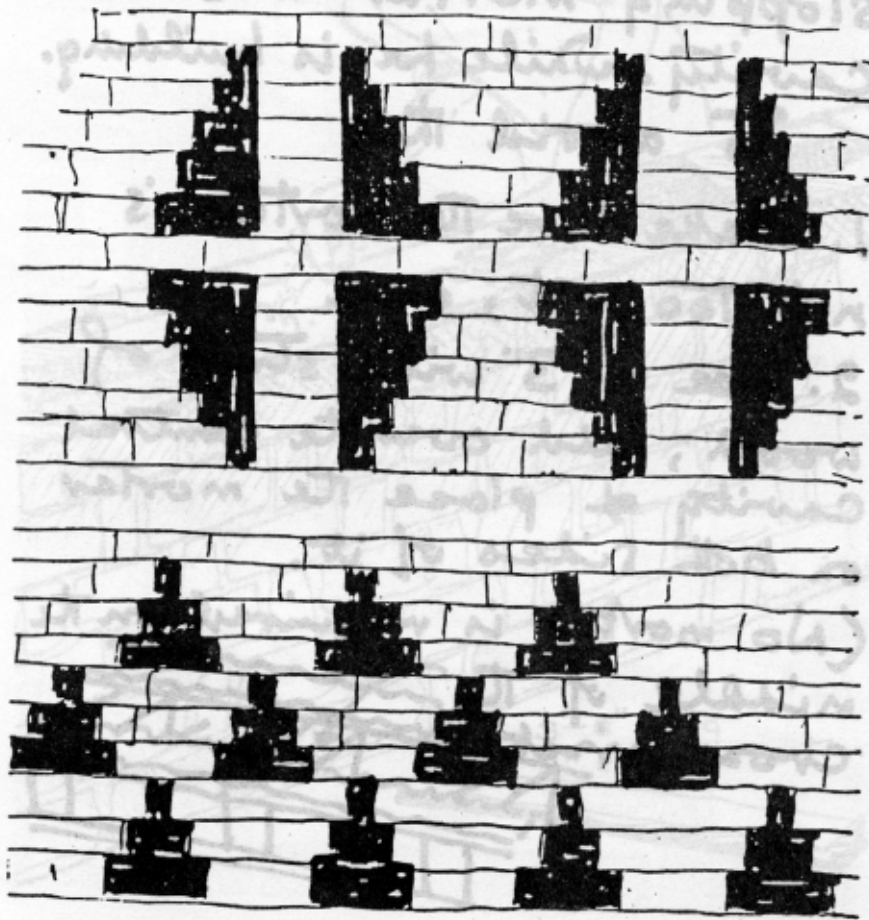
1. Make sure the mortar is not too wet, and
2. use a 3" wide strip of wood, laid over the central cavity & place the mortar on both sides of it.

(No mortar is required on the middle of the cross brick)



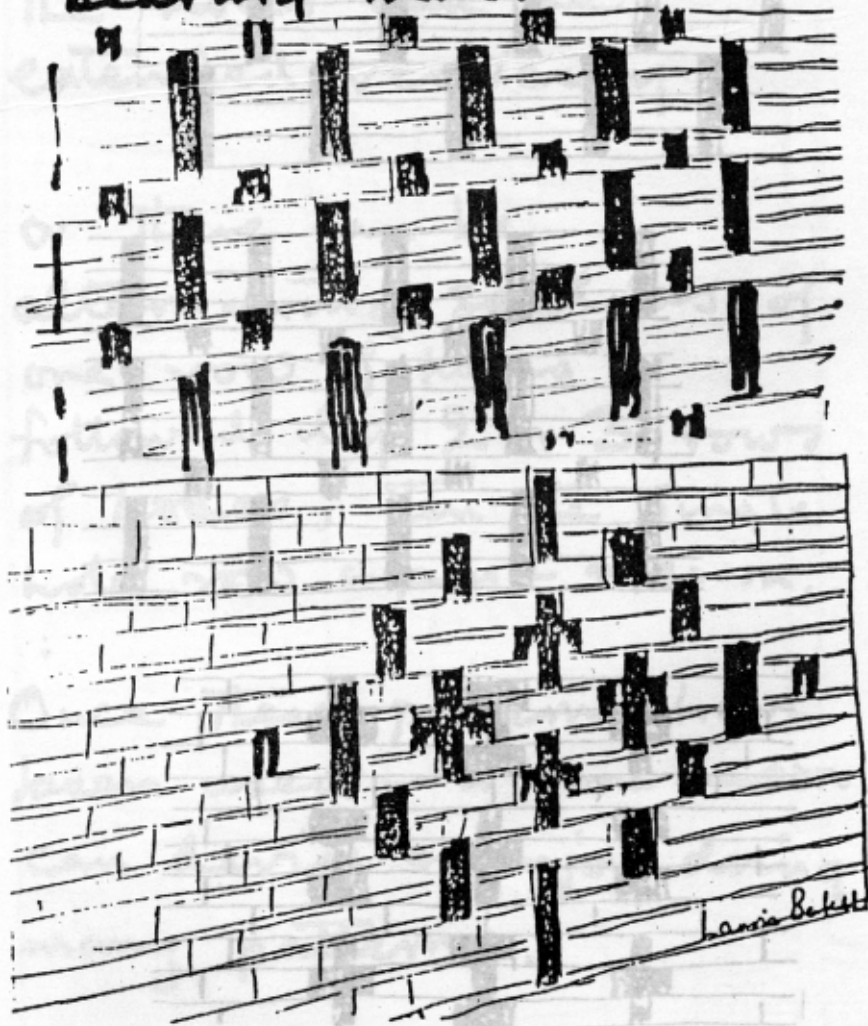
BRICK JALI

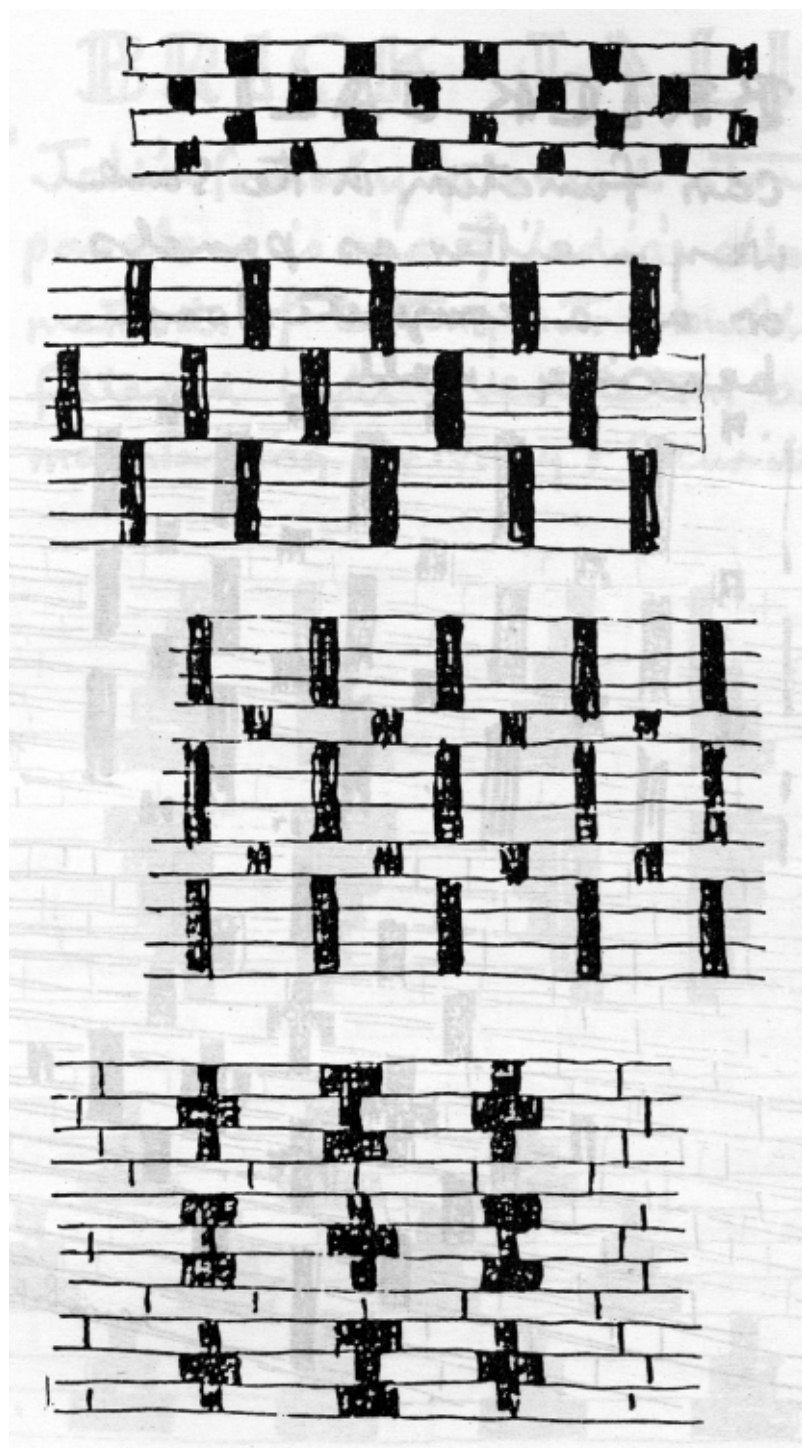
'Jali' - formerly pierced stone panels - is one of India's oldest methods of letting into a building filtered light & ventilation but maintaining privacy & security



BRICK JALI

can function in the same way - either as panels or as a complete load bearing wall.



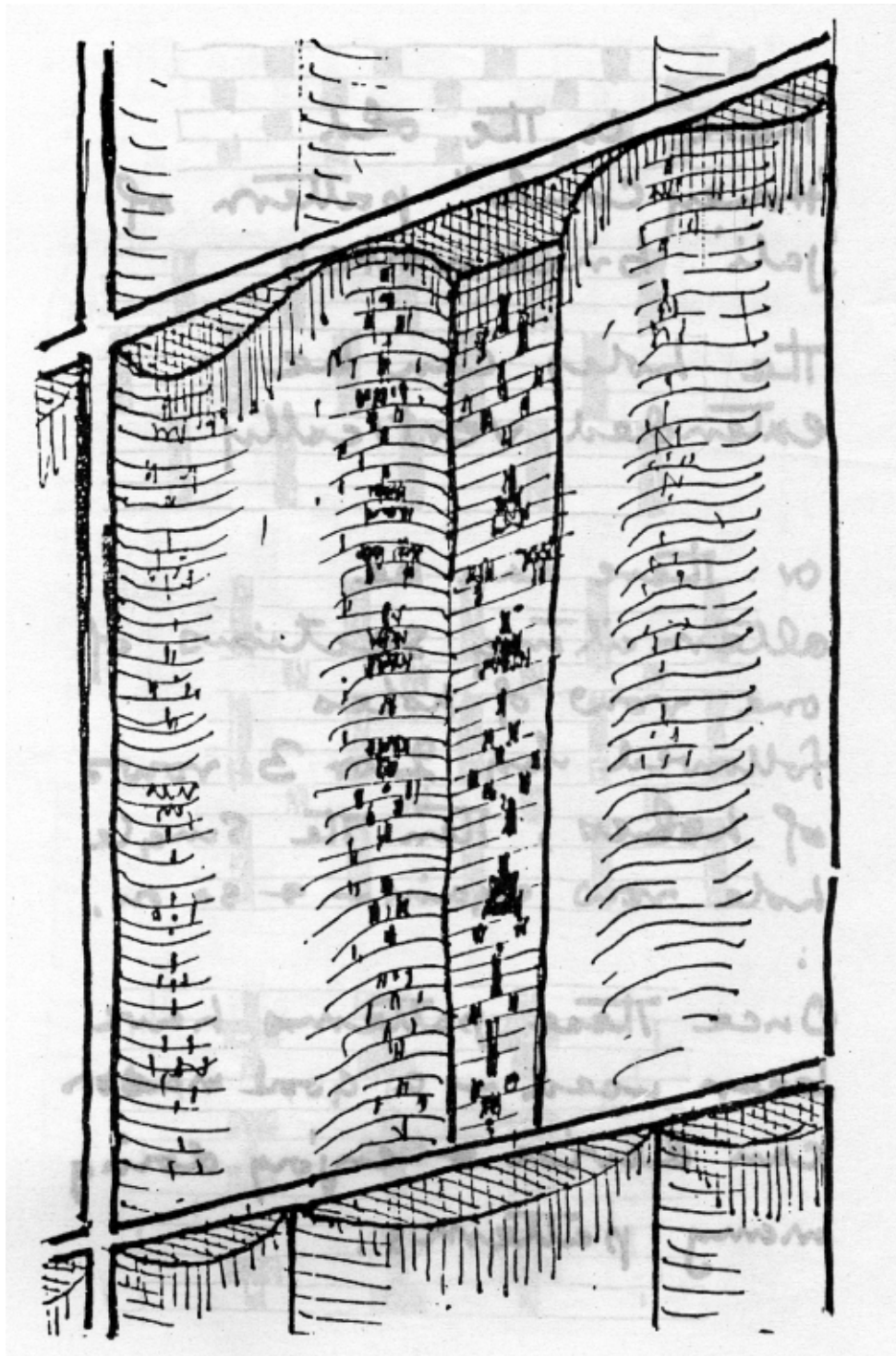


There is the old
"Honey Comb" pattern of
'jali' brick work

The holes can be
extended vertically

or there can be
alternating sections of
one row of holes
followed by 2 or 3 rows
of holes, then the single
hole row again - & so on.
:

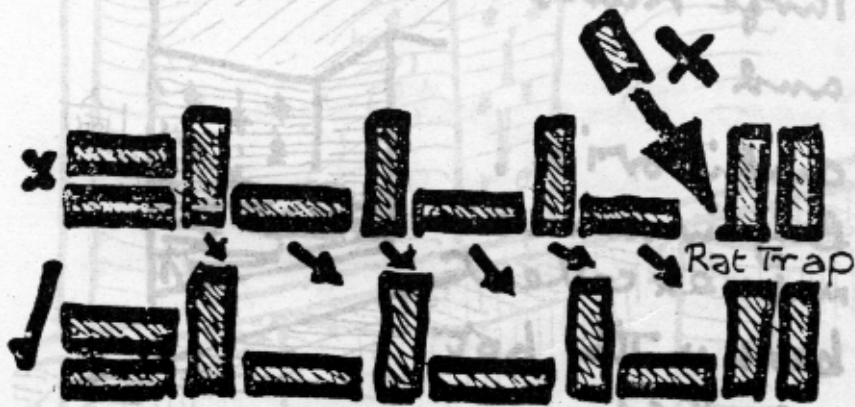
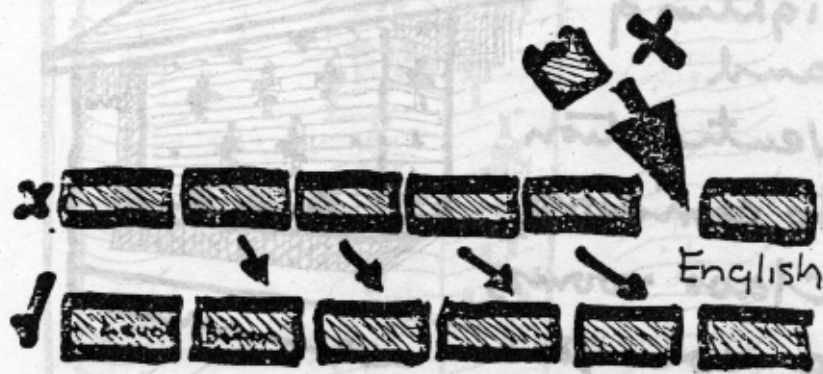
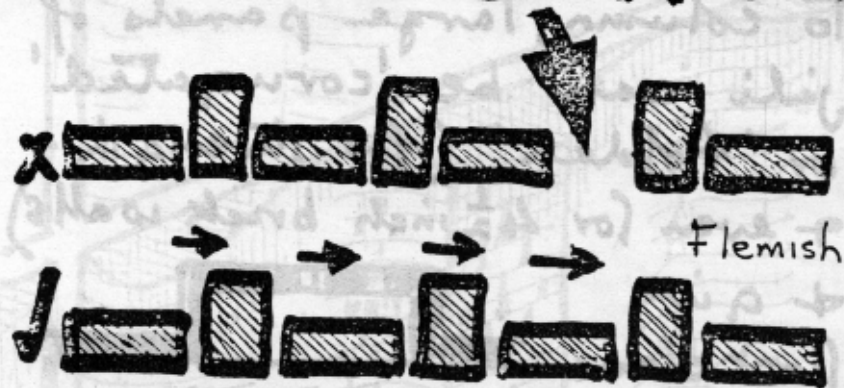
Once these patterns have
been used - a good mason
can devise & enjoy doing
many patterns.



Floor to ceiling, & column
to column, large panels of
juli can be 'corrugated'
or 'folded' (for strength -
& even for $4\frac{1}{2}$ inch brick walls)
& give
first class
lighting
and
ventilation
to corridors,
class rooms,
& even for
large halls
and
auditoria.
Bay 'windows'
make excellent
beds in the hot
weather.

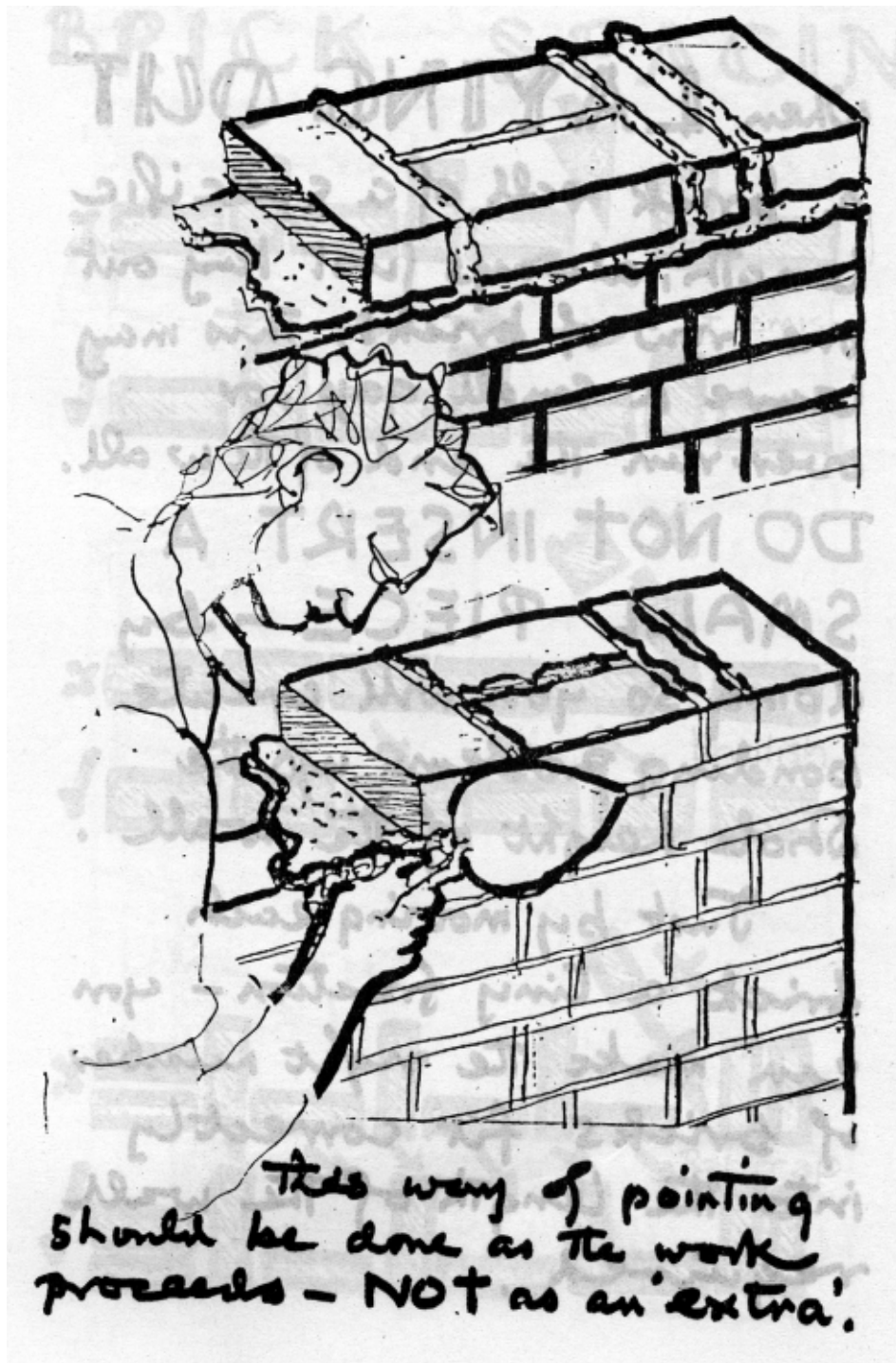


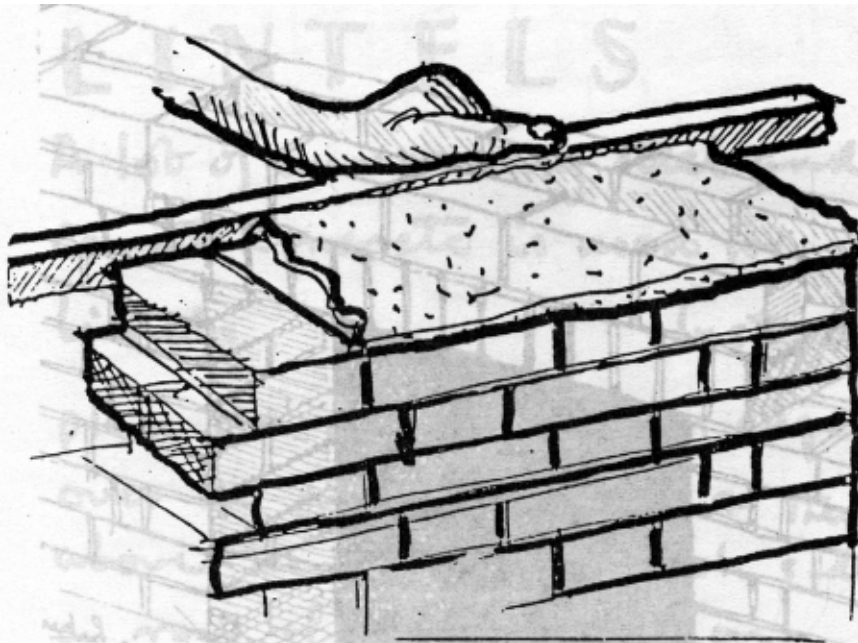
BRICK SPACING



When LAYING OUT
a brick wall of a specific
length, always first lay out
one row of bricks. This may
leave a small gap, or
over-run the end of the wall.
DO NOT INSERT A
SMALL PIECE - by
doing so you will create
bonding problems up the
whole height of the wall.

Just by moving each
brick a tiny fraction - you
can make the right number
of bricks fit correctly
into the length of the wall
required.

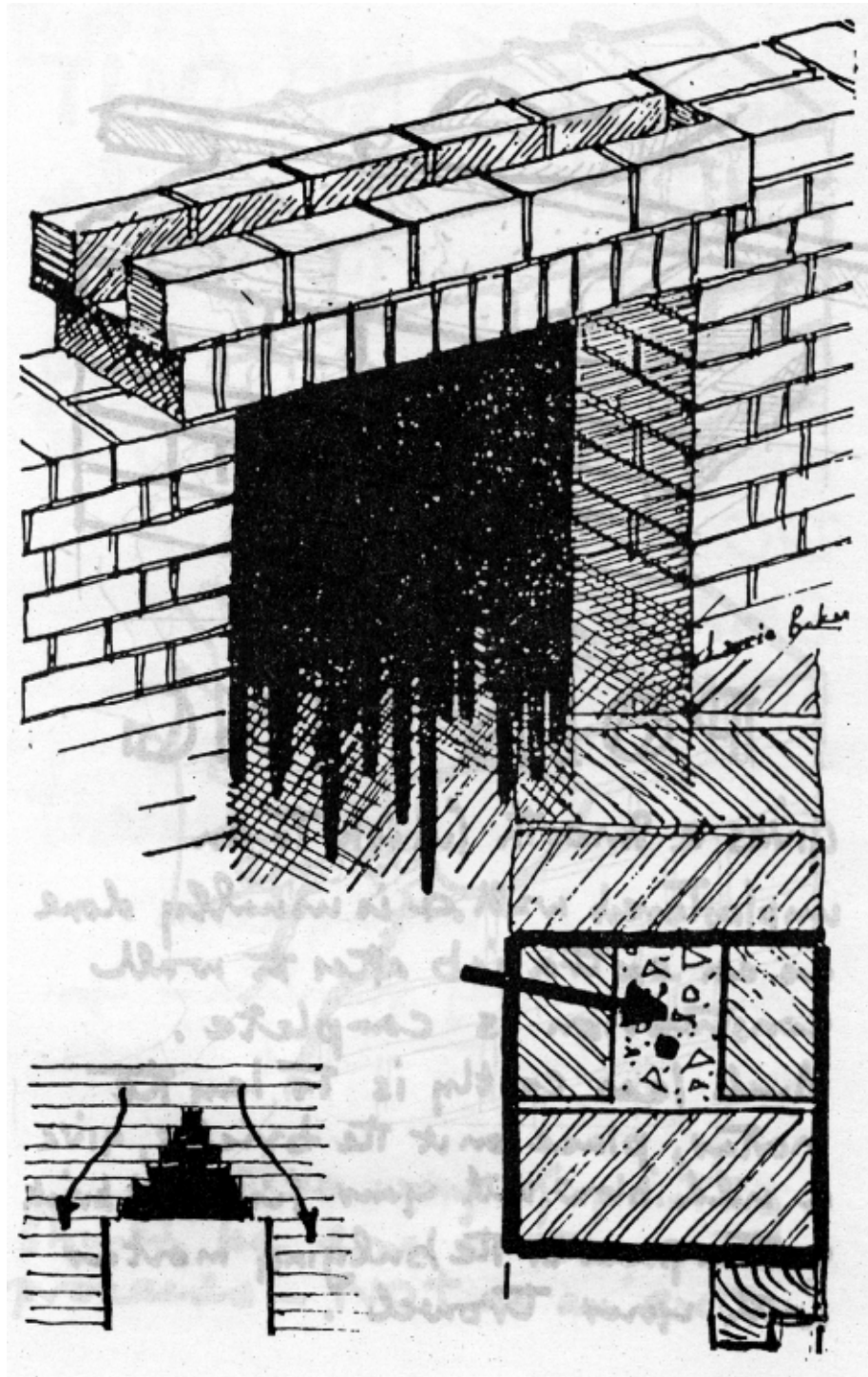




POINTING

Gives a smooth finish to an unplastered wall & is usually done as an extra job after the wall construction is complete.

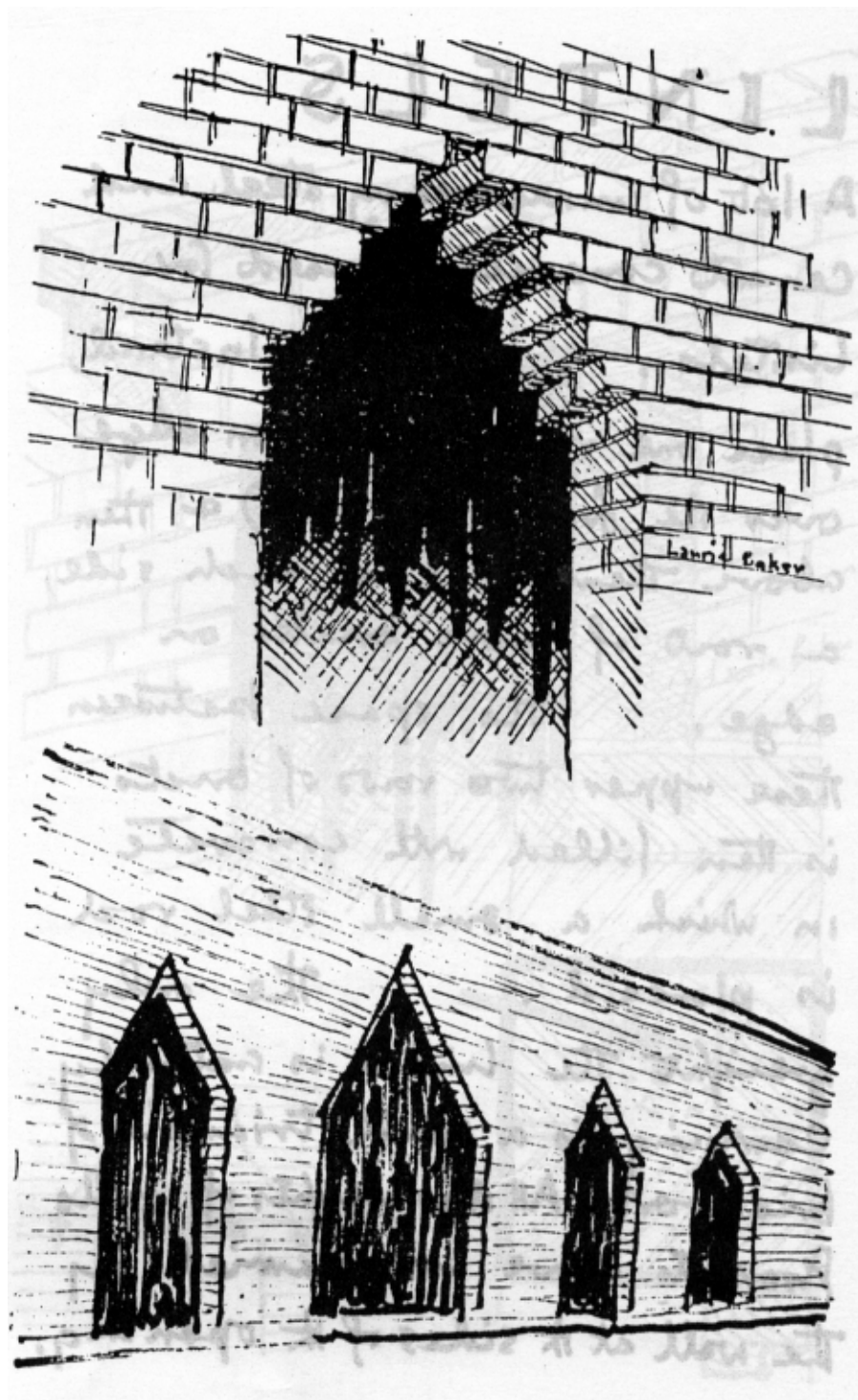
Much less costly is to lay the mortar, place on it the bricks, give a mild blow with your fist to the brick & then press in the bulging mortar with your trowel.



LINTELS

A lot of unnecessary steel and cement concrete is used for lintels.

Instead, place one row of bricks on edge over the frame (or space) & then above them, one on each side, a row of more bricks on edge. The space between these upper two rows of bricks is then filled with concrete in which a small steel rod is placed. The only weight the lintel is actually carrying is a small triangle of brickwork. All other weights of walls floors etc above are carried by the wall at its sides of the opening.



CORBEL ARCH

The usual round & segmental arches need shuttering or support during construction.

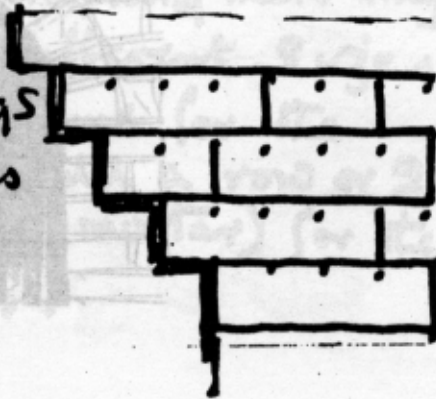
The corbel arch needs no support & is extremely simple & easy to make.

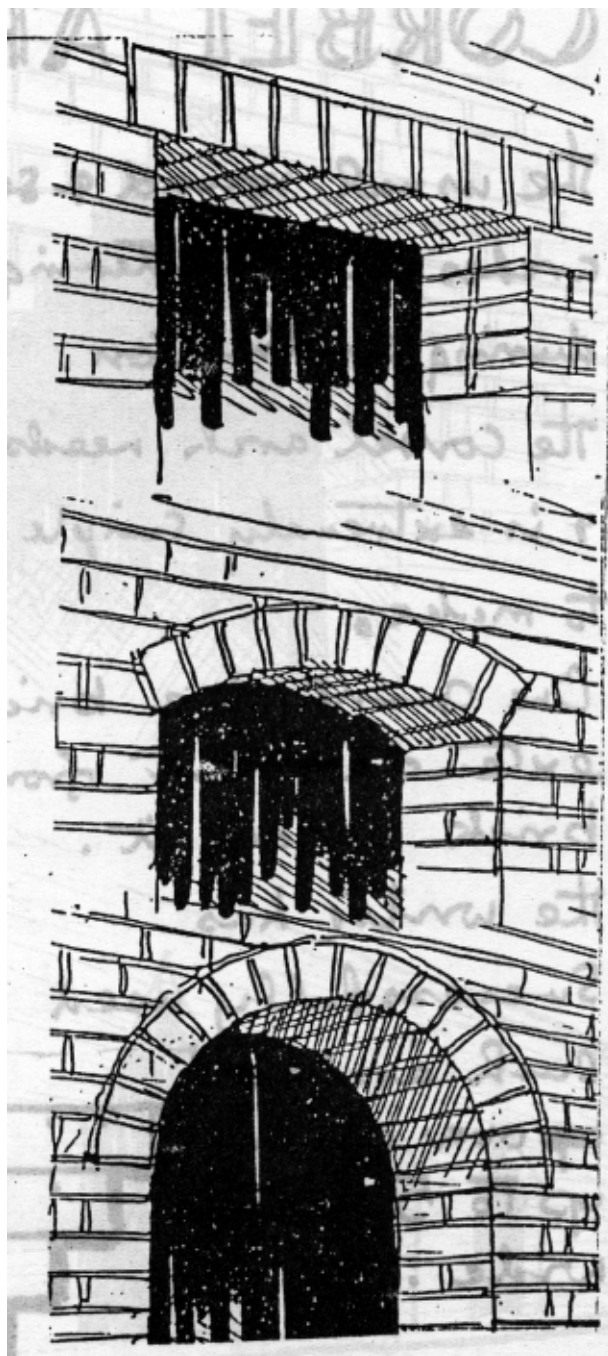
One quarter of a brick is extended out from the brick below it.

The writer has

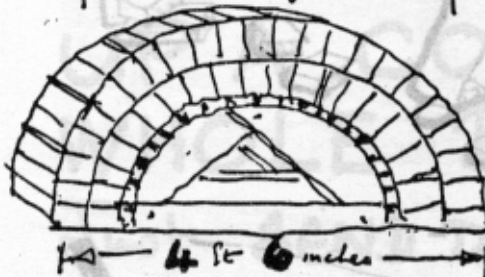
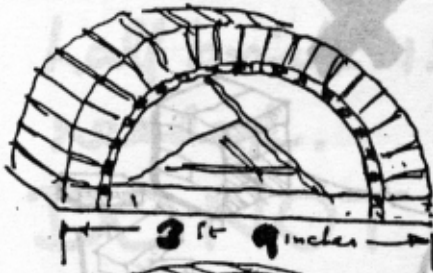
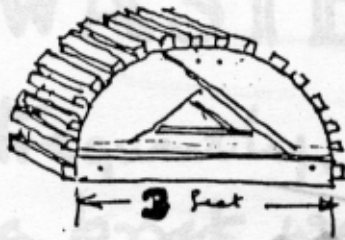
Successfully used

such arches
over openings
up to 5 metres
wide.





ARCHES



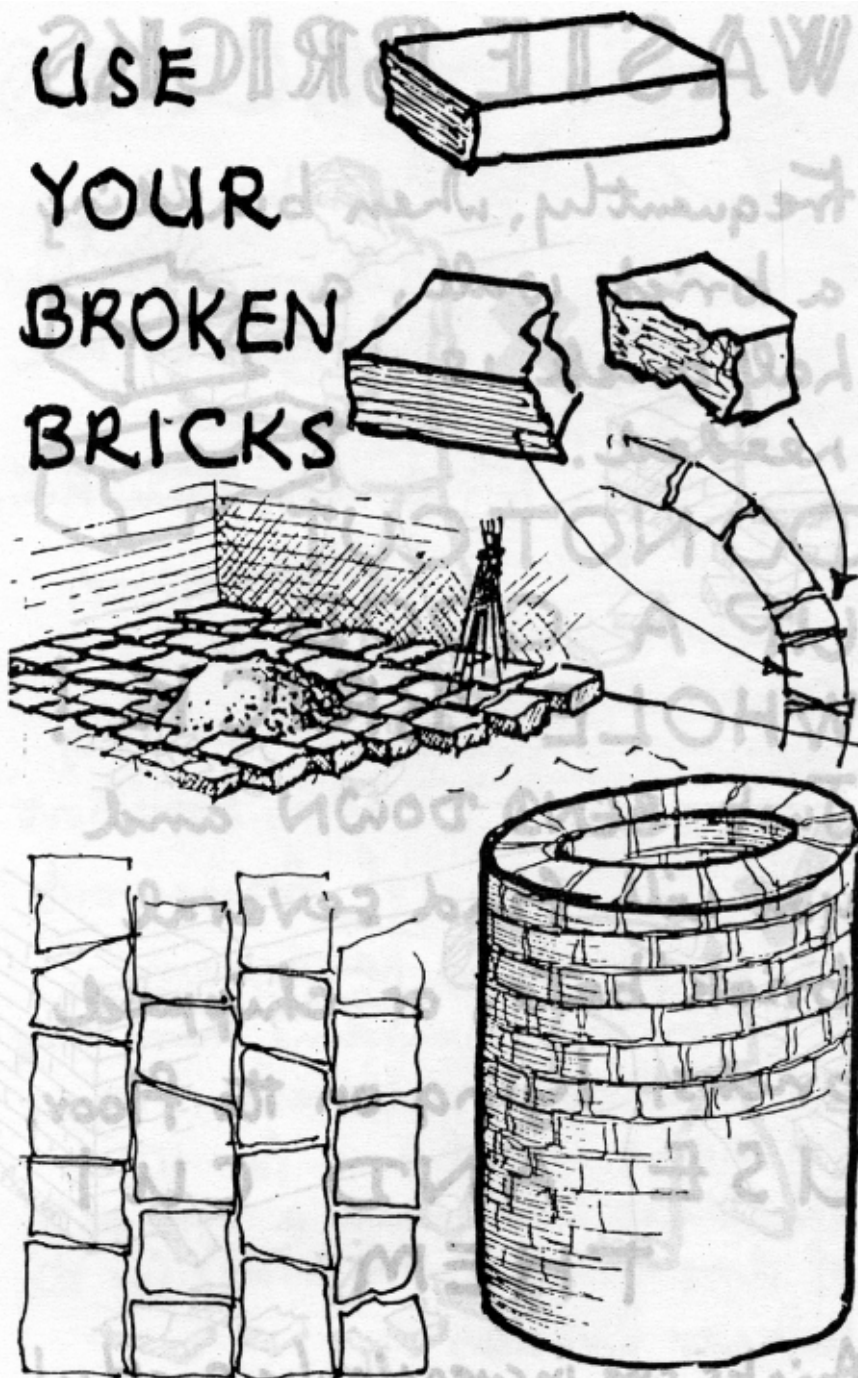
Can be of different shapes & sizes & are much less costly than R.C. lintels.

But while constructing them, some sort of framework

or support is necessary.

In one building there may be arches of different sizes so make one frame for the smallest — & add a row or 2 of dry bricks (no mortar) for the larger arches.

USE
YOUR
BROKEN
BRICKS



BROKEN BRICK PIECES

On most sites where brick is being used, there are plenty of broken pieces lying on the ground.

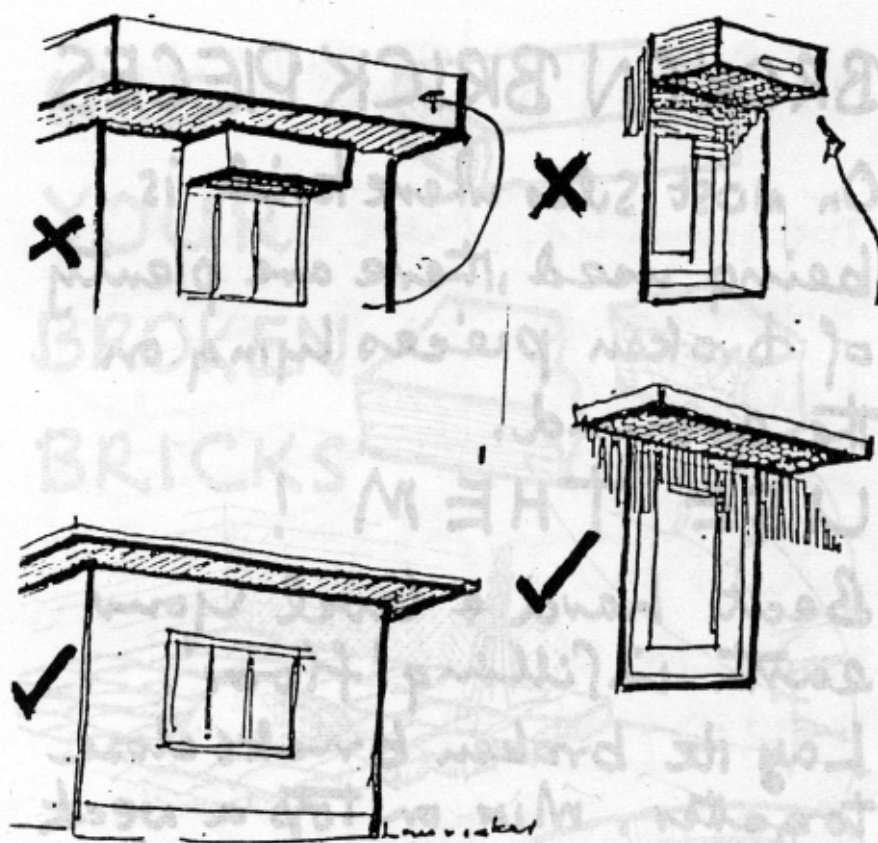
USE THEM !

Beat hard & level your earth in filling 'floor'.

Lay the broken bricks close together. Mix on top a weak lime mortar & brush it in & you have an excellent base for tile or plaster flooring.

For LEECH PITS

(see elsewhere) lay the broken pieces in a circle with **DA7** joints. Then a layer of horizontal all mortar — & another layer.



FANCY SUNSHADES

Serve no purpose except to collect leaves.

They are unnecessary & costly — so

DONT USE THEM



DONT USE PLASTER

unless it is really necessary.
Put it all over a building & it
accounts for about 10% of the
Total cost!

Fungus grows on it outside.
People finger it, & lean on it,
inside. It either looks
dirty & ugly or you have to
repaint it every year at
considerable cost.

There are a few places where it is
useful - kitchen, bathroom,
but elsewhere, neat brick work
looks better.

MORTARS AND

CEMENT & SAND
1 PART 8 PARTS

Use Cement only if nothing else is available. It is an 'energy-intensive' material

LIME & SAND
1 PART 3 PARTS

Good for all types of brick & stone work. (The setting time is slower than cement).

LIME, CEMENT & SAND
1 PART 4 PARTS 14 PARTS

This sets almost as quickly as cement

PLASTER

LIME & SURKI & SAND
1 PART. 2 PARTS 6 PARTS

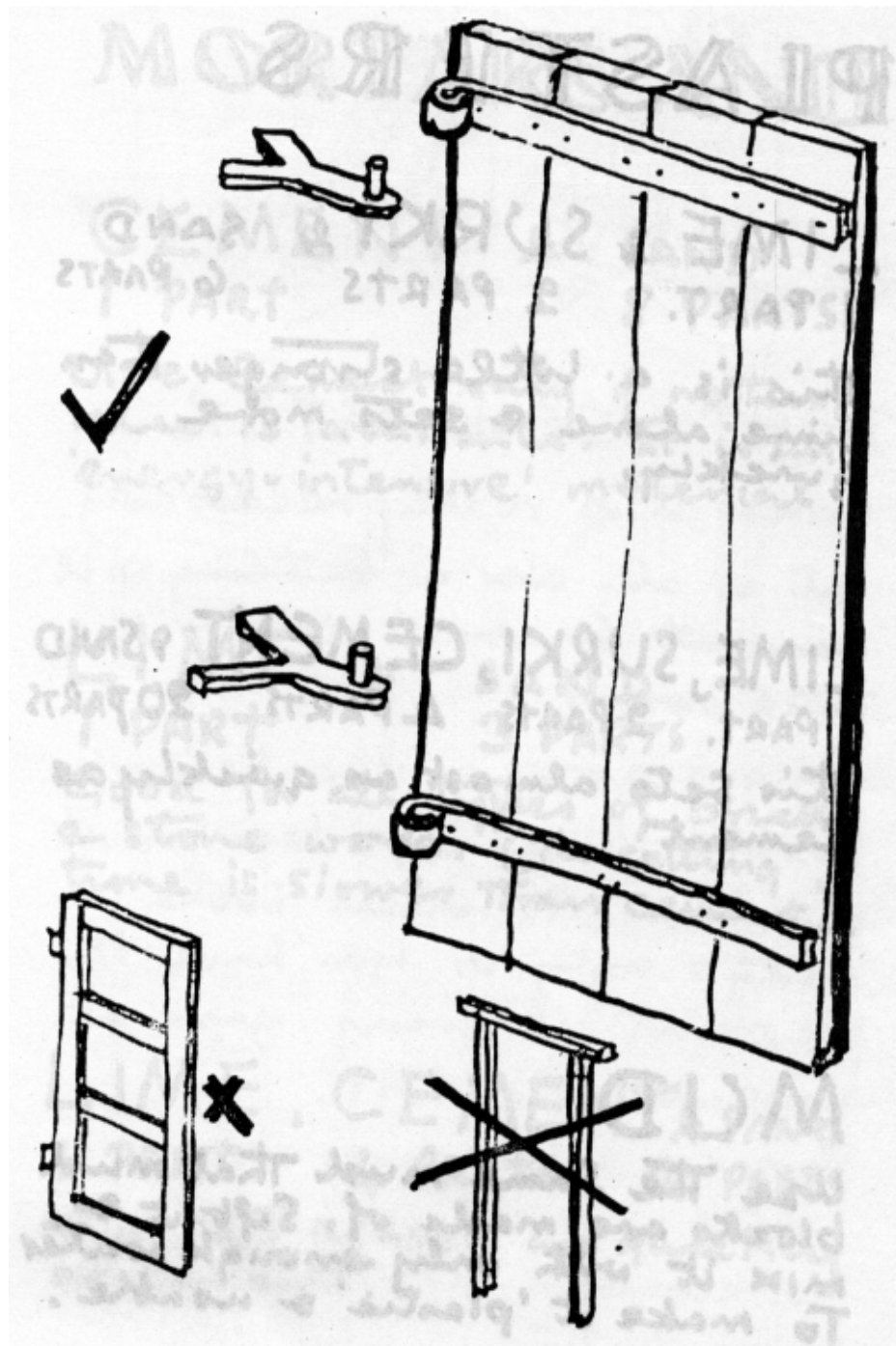
This is a little stronger than
lime alone & sets more
quickly.

LIME, SURKI, CEMENT & SAND
1 PART. 2 PARTS 4 PARTS 20 PARTS

This sets almost as quickly as
Cement

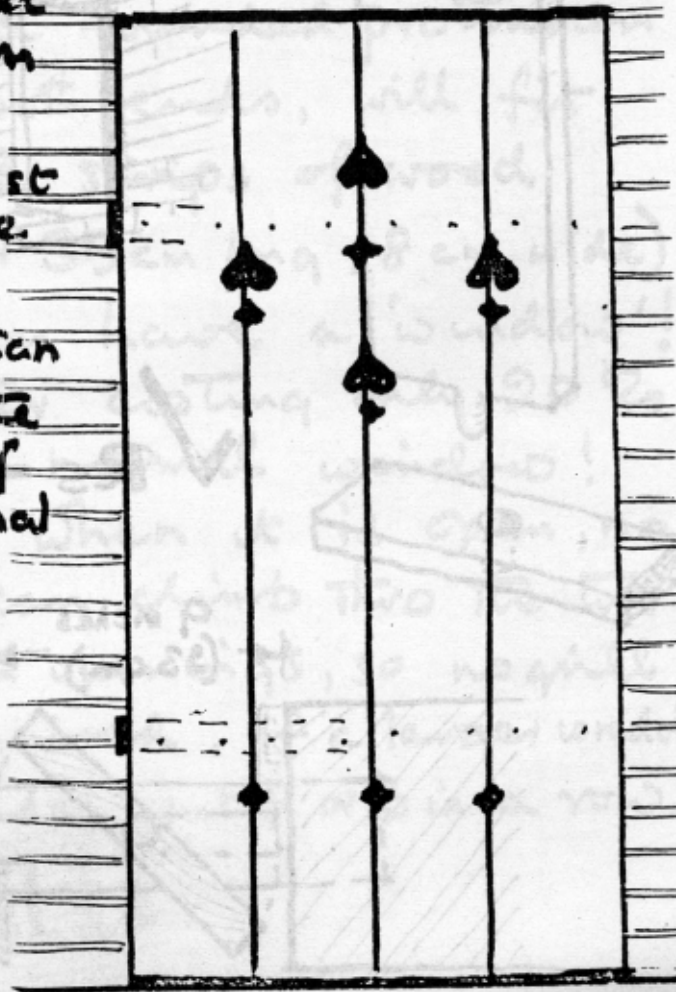
MUD.

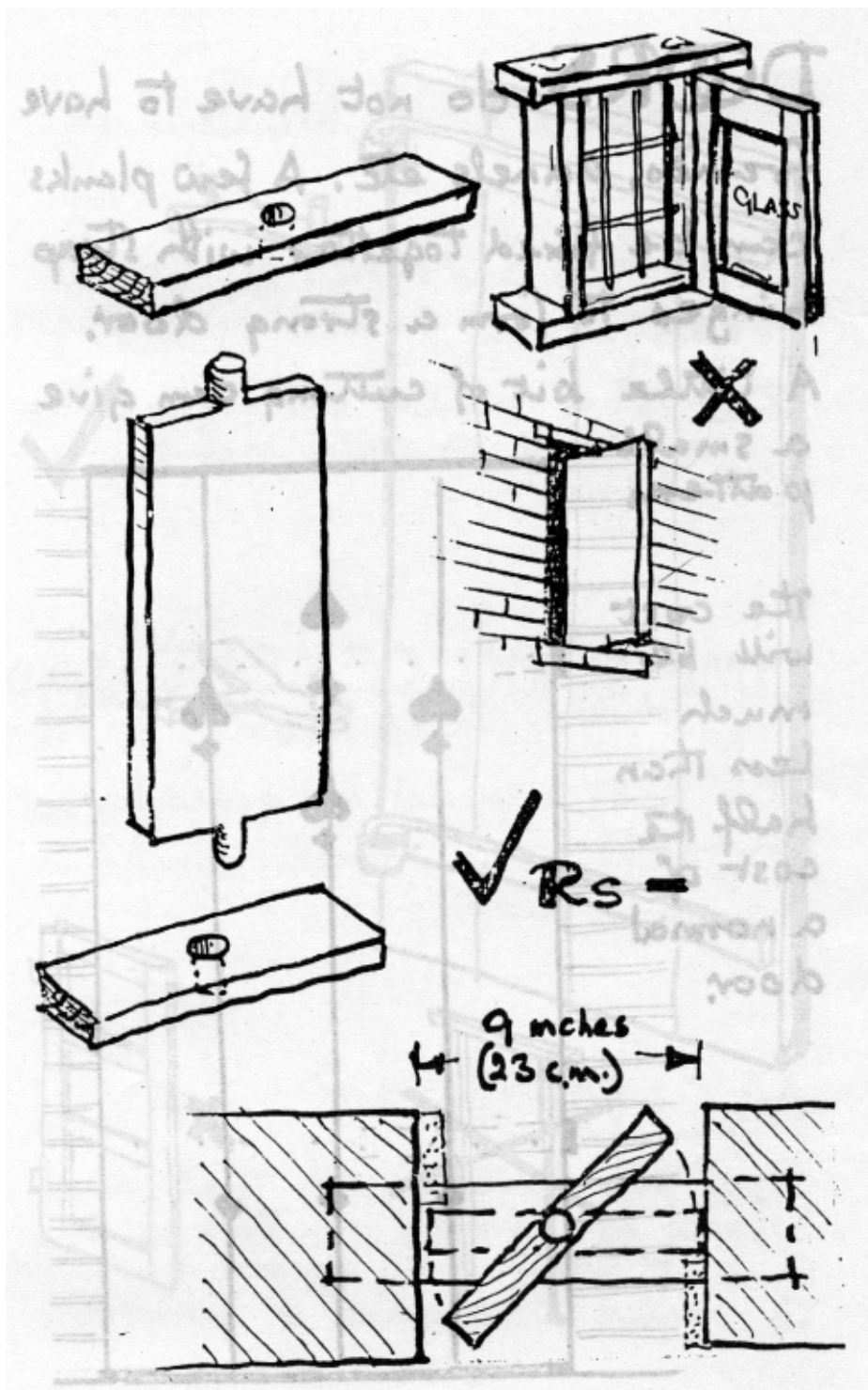
Use The Same mud That mud
blocks are made of. Sift it &
mix it with only enough water
To make it 'plastic' & usable.



DOORS do not have to have frames, panels etc. A few planks can be fixed together with strap hinges to form a strong door. A little bit of cutting can give a small pattern

The cost will be much less than half the cost of a normal door.

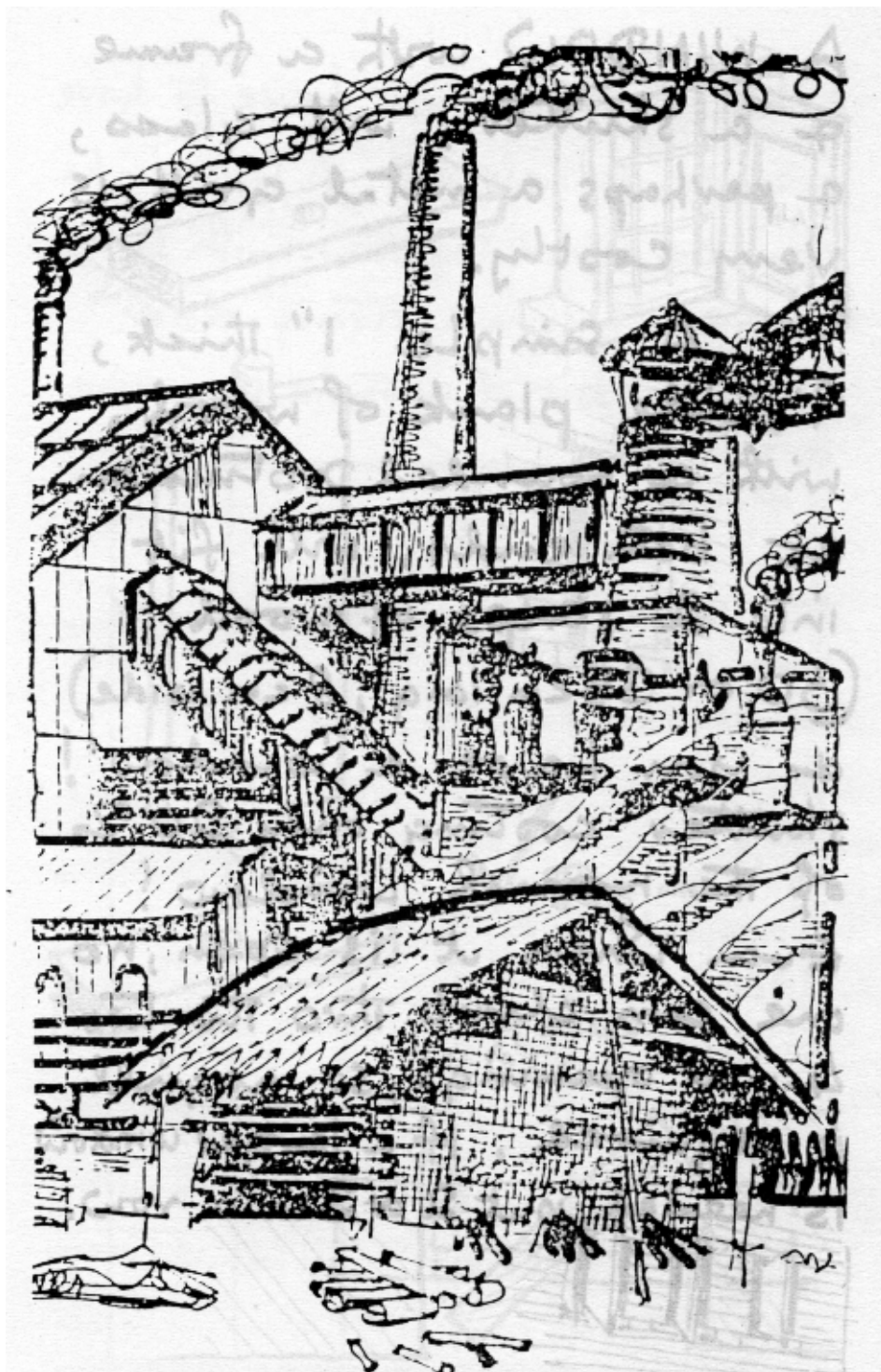




A WINDOW with a frame
& a shutter, with glass,
& perhaps a metal grill, is
very costly.

A simple 1" thick,
9" wide plank of wood,
with a rounded protrusion
at both ends, will fit
into 2 strips of wood
(30 or 35 cm long, 8 cm wide)
& you have a 'window'!
shutter costing only 20%
of the normal window!
Even when it is open, no
one can climb thro the two
4 inch openings, so no grill
is required. If a larger window
is needed, put 2 or 3 in a row.





The production of CEMENT & STEEL

both use an enormous amount of ENERGY (Fuel) and cause a lot of air pollution.

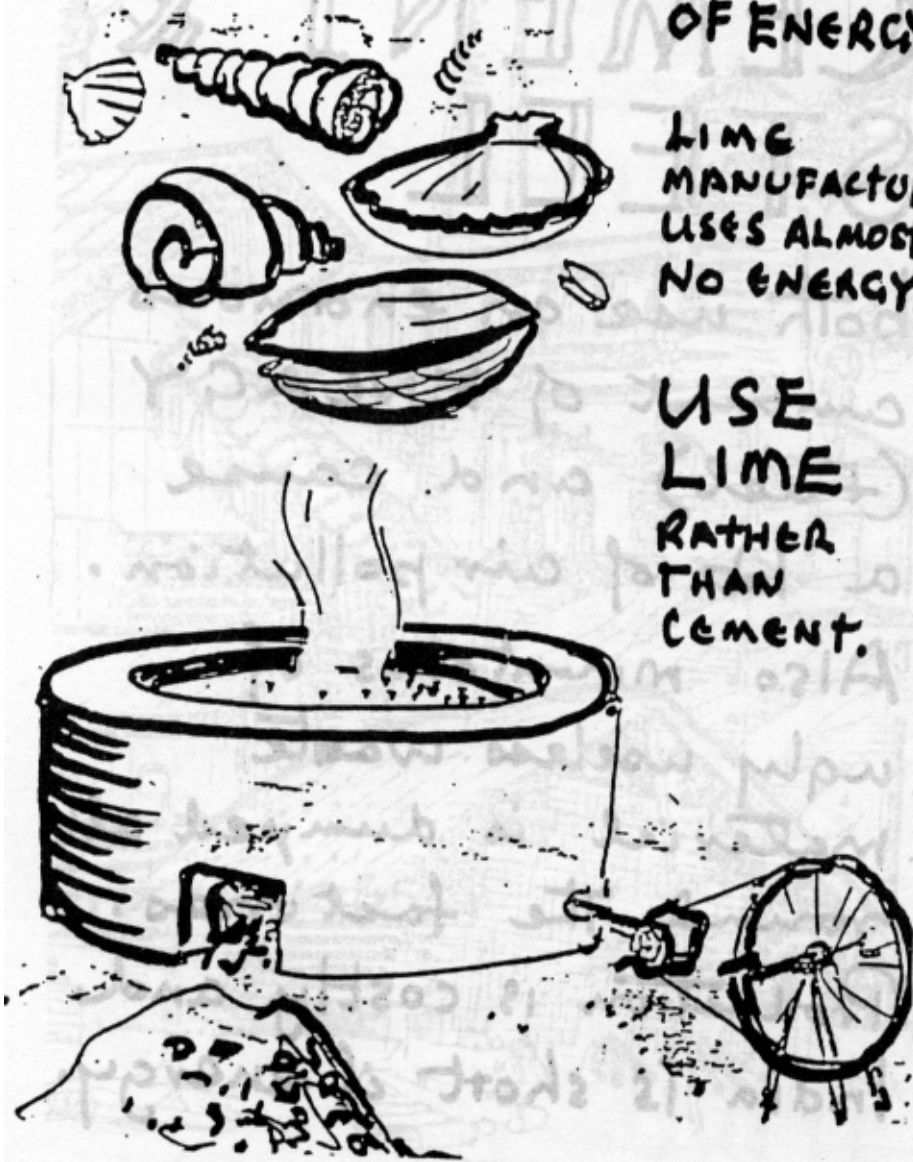
Also mountains of ugly useless waste material is dumped all round the factories.

Production is costly and India is short of energy.

INDIA
IS SHORT
OF ENERGY.

LIME
MANUFACTURE
USES ALMOST
NO ENERGY.

USE
LIME
RATHER
THAN
CEMENT.



LIME

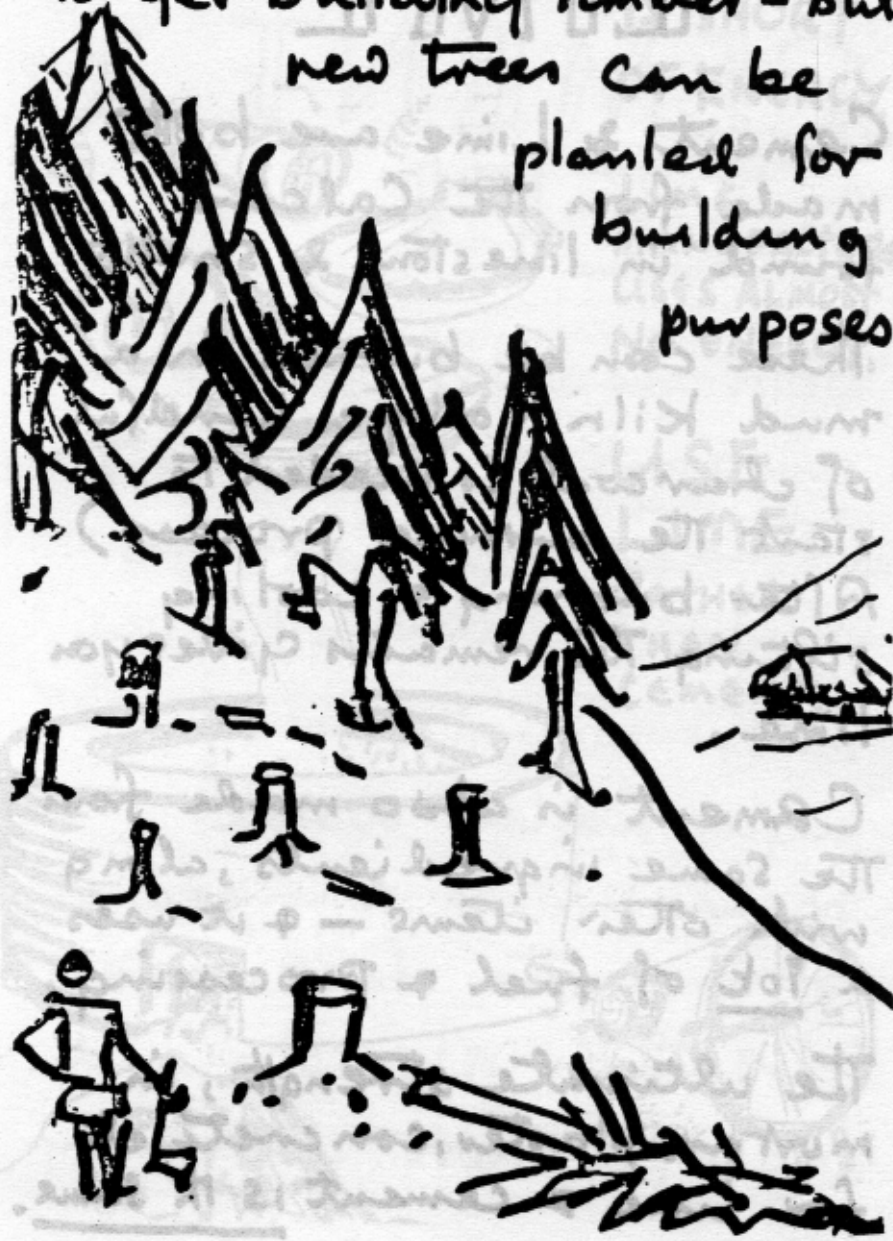
Cement & Lime are both made from the Calcium found in limestone & shells.

These can be burned in a mud kiln (only a handful of charcoal is needed to start the burning process) After burning & cooling sifting the remains gives you lime.

Cement is also made from the same ingredients, along with other items - & it uses a lot of fuel & processing.

The ultimate strength, in mortar, plaster, concrete etc for lime & cement is the same.

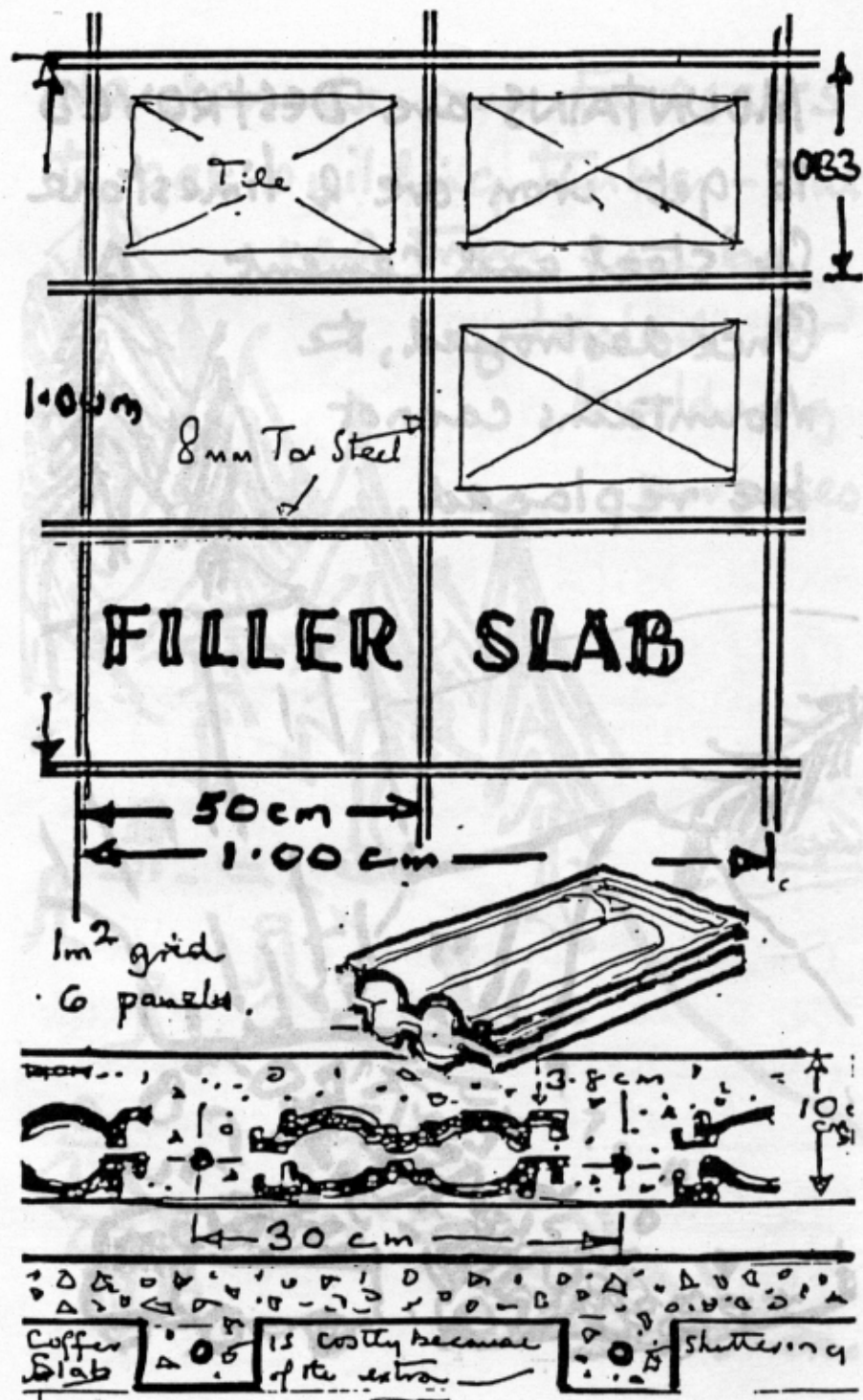
We denude our FORESTS
to get building timber - but
new trees can be
planted for
building
purposes.

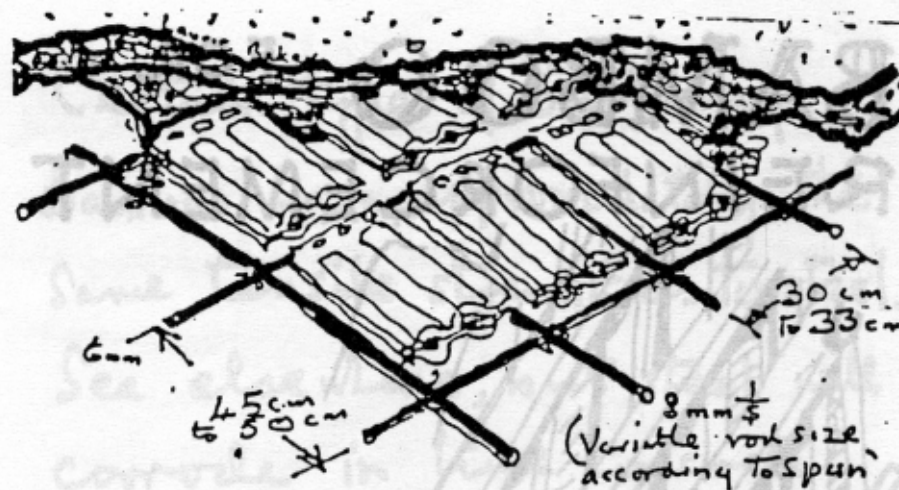


MOUNTAINS are DESTROYED
To get iron ore & limestone
for steel and cement.

Once destroyed, the
Mountains cannot
be replaced.





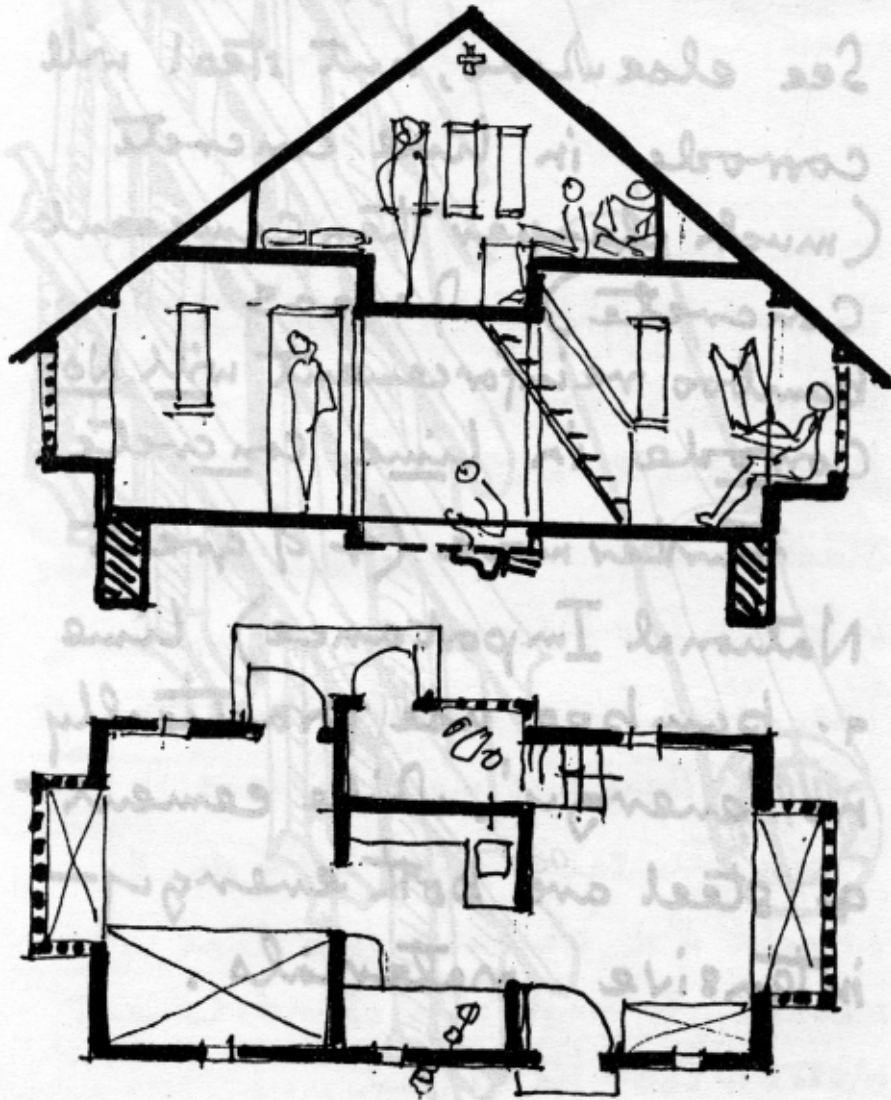


In the orthodox reinforced concrete slab the dead weight of the concrete is heavy. This weight can be lessened by putting light weight material between the steel rods.

The simplest 'filler' is to use two fifth grade Mangalore Tiles. These have no structural strength value — They are mere 'Fillers'.

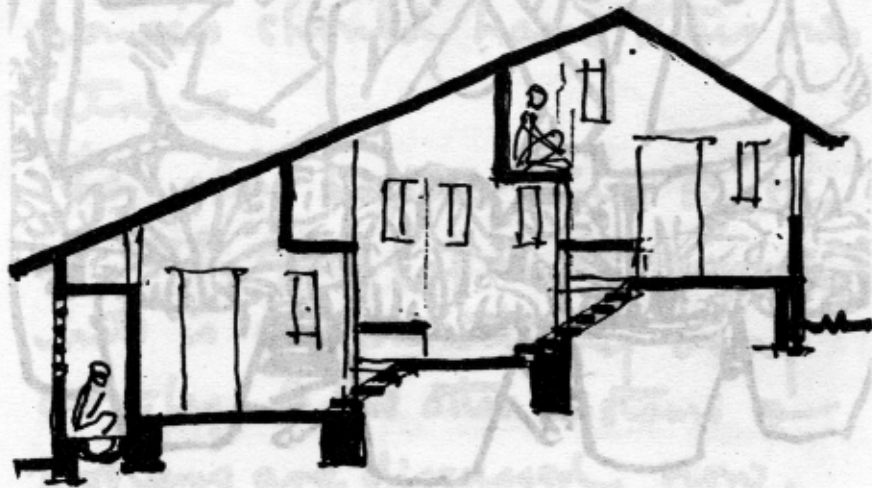
Using them saves about 30% dead weight of the 'slab' — so less steel is needed. — So much Steel, Sand, Cement Metal & Cost is saved.

These sections show how the 'living space' is increased without enlarging the total floor area of a small house.



LOFTS & BUNKS

When a sloping roof is asked for (or a sloping site makes a sloping roof more economical) there is usually quite a lot of "spare space" under the lower sloping parts & these can be used not only for shelves & storage but also for seats & beds.





LATRINES

Whenever the need for housing schemes comes up, inevitably eventually the subject of latrines surfaces. Almost invariably, for community housing, someone suggests 'Group Latrines'. This idea has rarely, if ever, been successful & there is every reason why all new houses should have their own latrine.

The old Septic Tank system is still good (if built properly) but is comparatively very costly. A few other systems & problems are discussed now.

The Elderly,

most

Women,

and children,

Do NOT like going down the garden
during the
night.

So Put

Your latrine

in the

house -

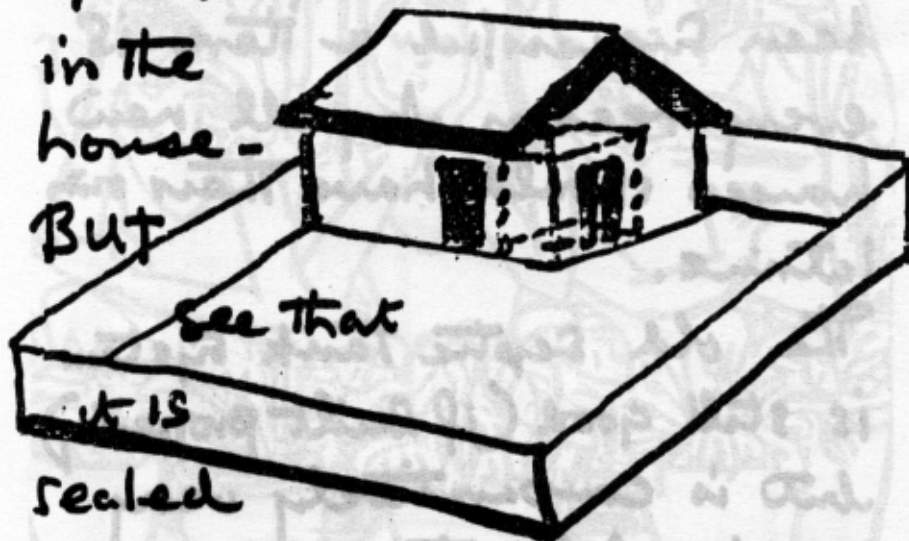
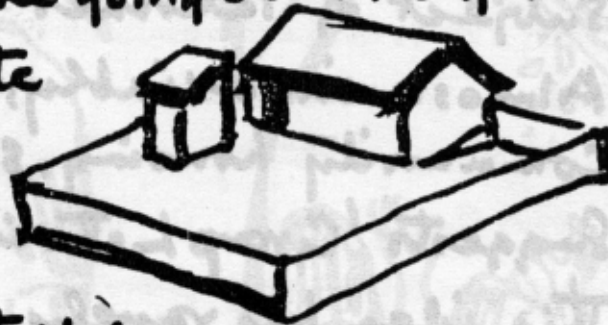
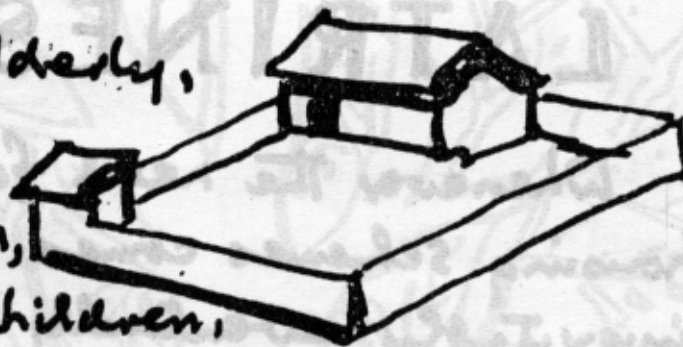
But

See that

it is

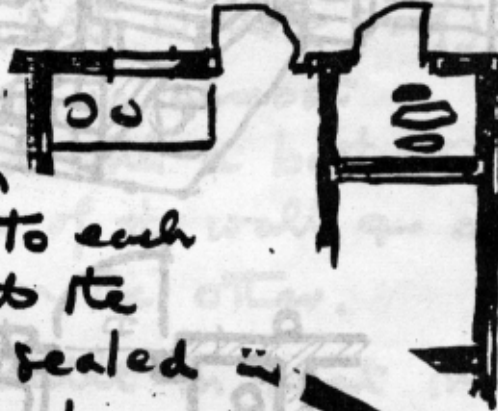
sealed

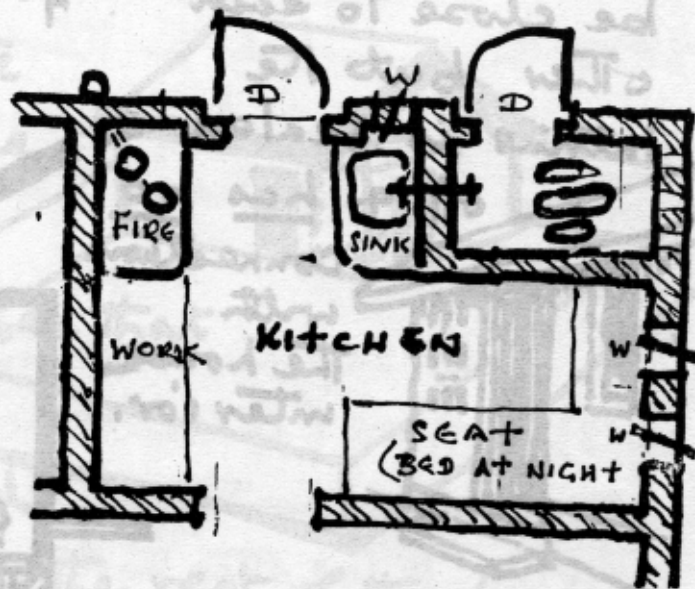
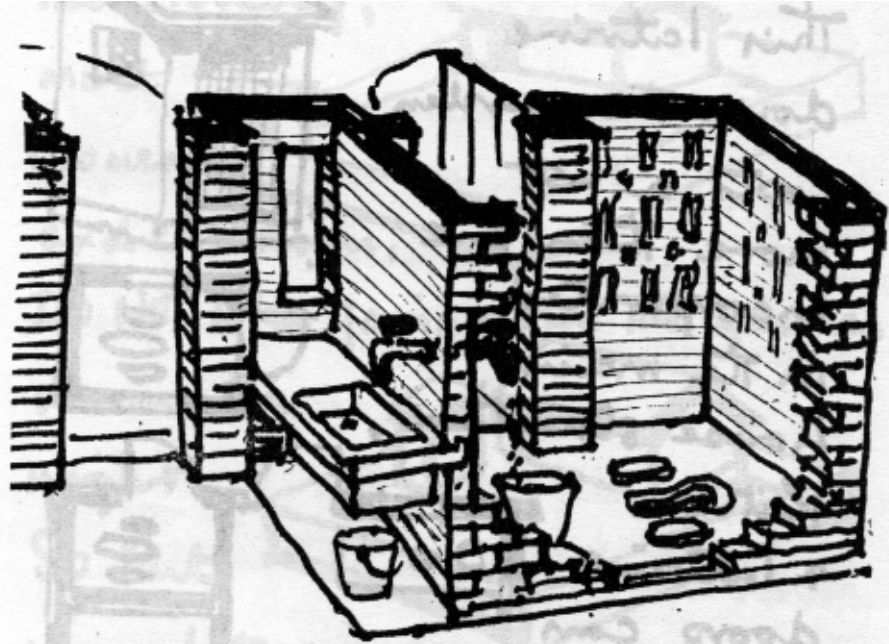
off from the rest of the house.



This latrine
down the garden
costs a lot
more than one
incorporated
in the main
house structure.

Kitchen
& latrine
doors can
be close to each
other but the
latrine is sealed
off & has no
connection
with
the house
interior.





Many families do not like to have the latrine under the house roof. Such prejudices can be removed if the lavatory is sealed off from the rest of the house (both walls & roof). Water piping is almost eliminated with a bath tap on one side of the wall & a Sink Tap on the other.

A wide built in seat in the Kitchen can act as an extra bed at night.

A smokeless chula can be near the door

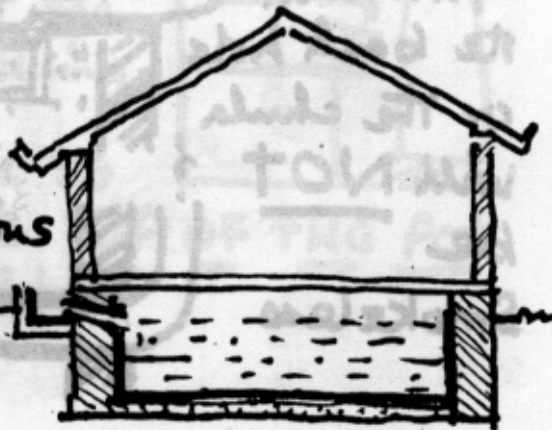


RAIN WATER HARVESTING

is currently much talked about & desirable. However there must be suitable places to store the 'harvest'! We also have to avoid evaporation.

One such place is the space between foundation & ground floor - but such a floor will be costly, as also the waterproofing of base & plinth walls.

The system would be better if we had continuous rain!



Burnt Clay Chulas
 Can be built into
 the kitchen work
 'table'. If
 there are 2
 holes, two
 pots can be
 used at the
 same time.

If you are
 only
 using one ² smoke
 pot - then
 put a pot
 of water on
 the back hole
 of the chula
 will **NOT**
 be
 Smokeless



SMOKELESS CHULAS

Formerly most
people did their
cooking on the
floor.



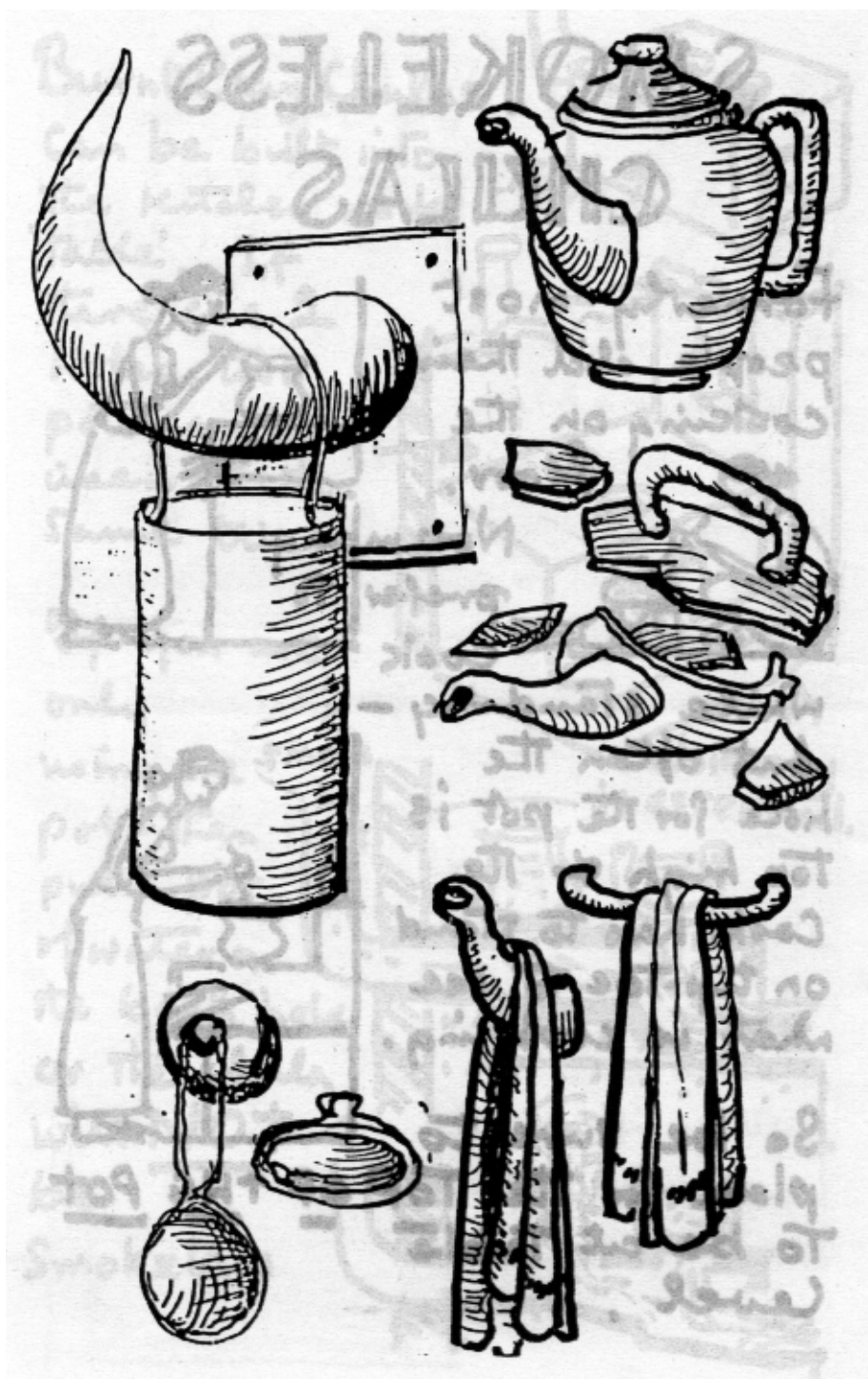
Now many
prefer to
cook



while standing -
but often the
hole for the pot is
too high & the
Cook has to stand
on tip-toe to see
what is cooking.



So be sure to
plan for the TOP OF THE POT
To be at Table
level .



SMOKELESS CHULAS

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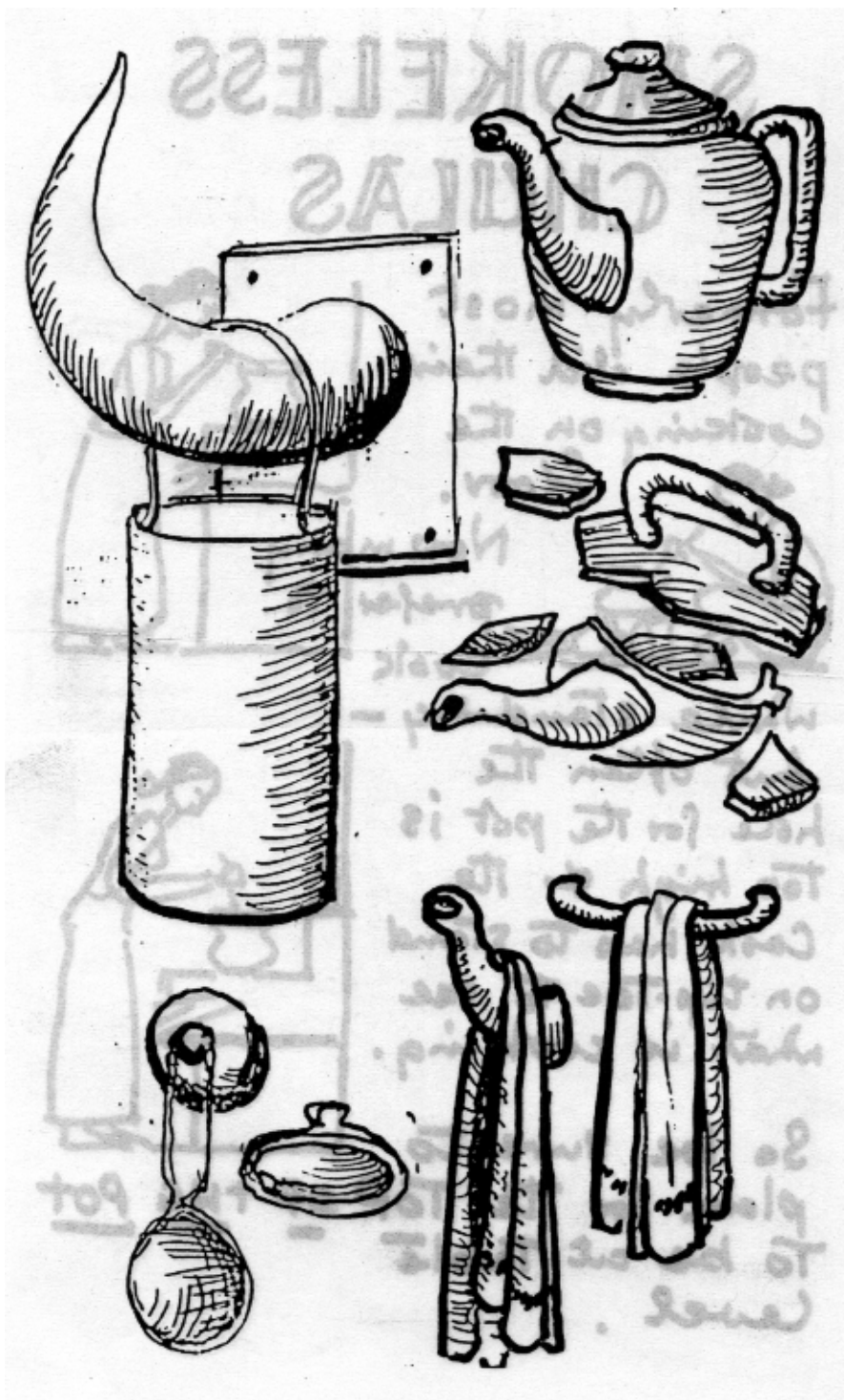
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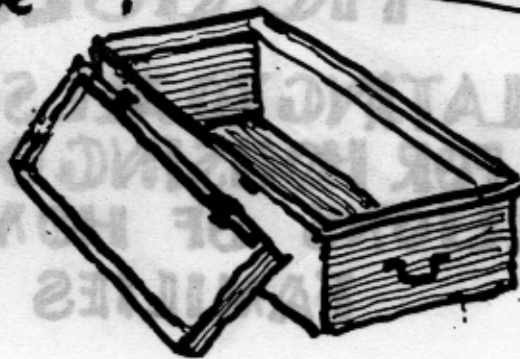
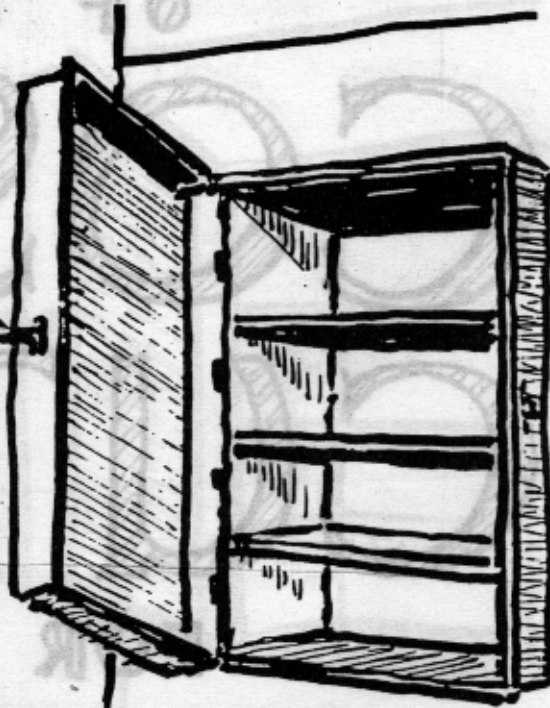
So be sure to
plan for the TOP of the POT
to be at Table
level .



MAKE USE OF OLD WASTE

Fix back the lid onto an old tin trunk & build it in to the wall & you have a rat and insect proof almirah.

Broken-off lids, spouts, horns, etc can all be used as hooks and hangers.



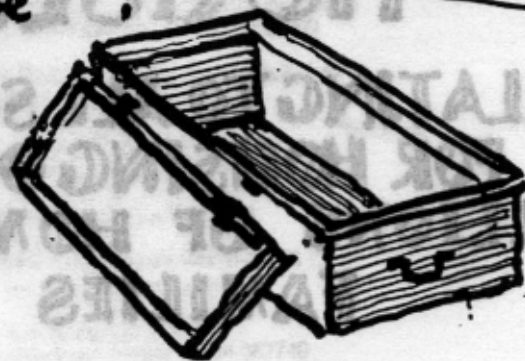
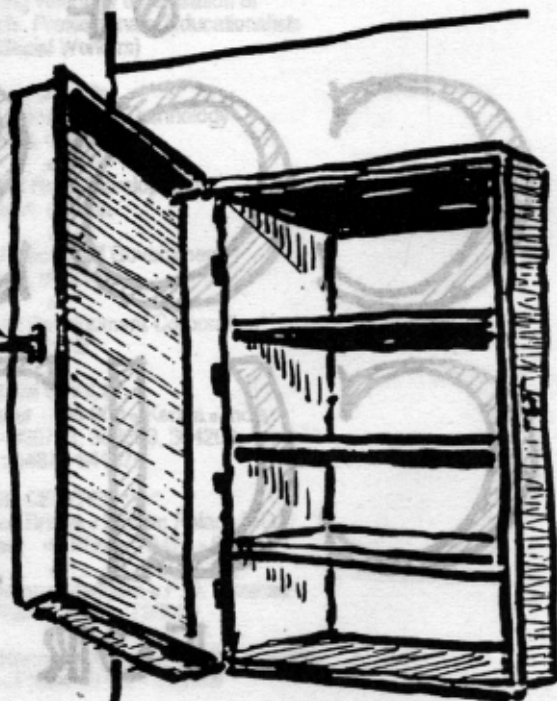
MANUAL
OF
COST
CUTS
FOR
SMALL
HOUSES

RELATING TO ALL SCHEMES
FOR HOUSING OUR
MILLIONS OF HOMELESS
FAMILIES

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FAMILIES

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